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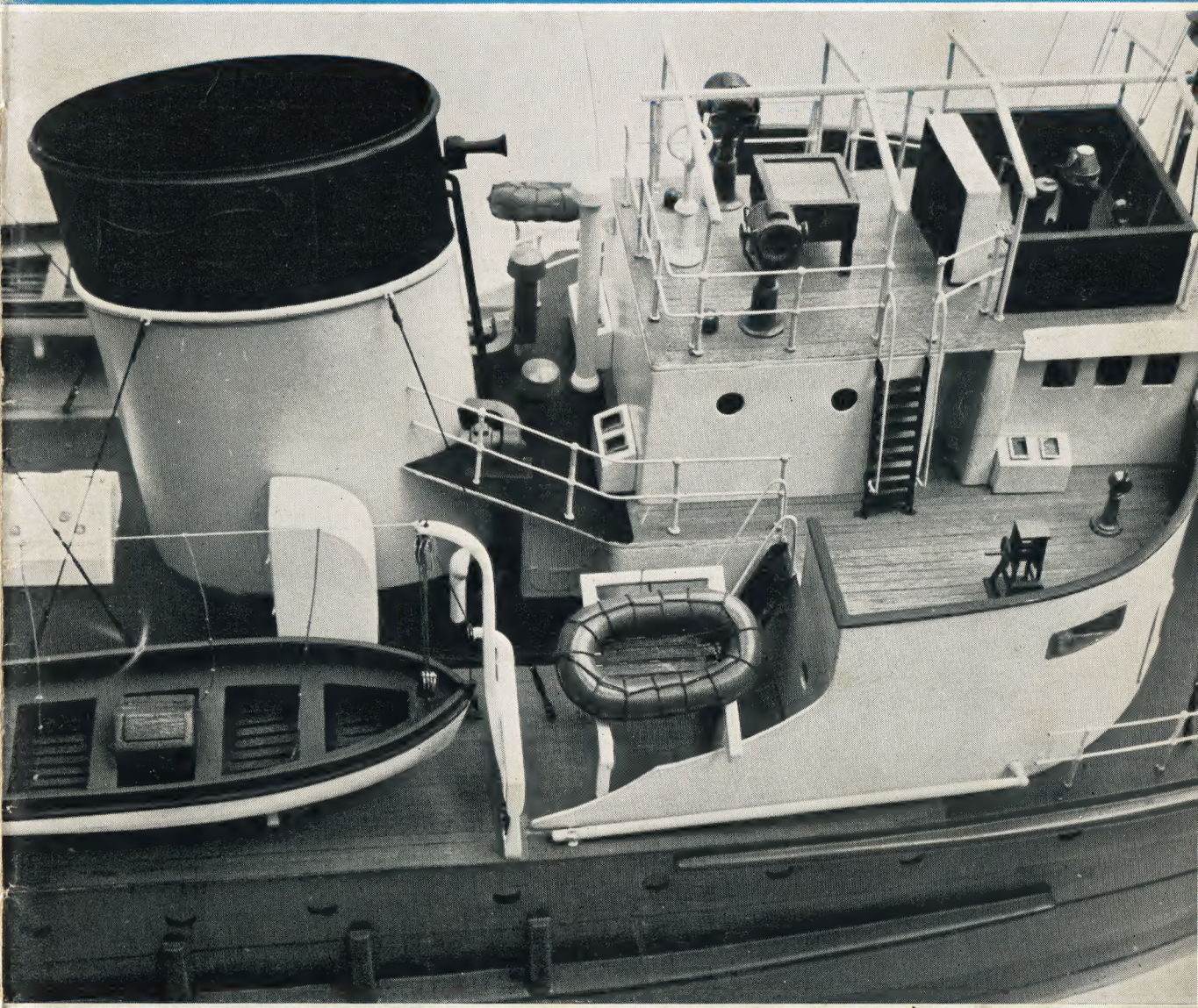

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● THE 50 c.c. "BUMBLE BEE" PETROL ENGINE ● TIME AND MOTION STUDY IN MODEL ENGINEERING ● READERS' LETTERS ● GAS TURBINE DEVELOPMENT ● REGULATOR AND SUPER-HEATER FOR TITFIELD THUNDERBOLT ● EXTERNAL LAPPING

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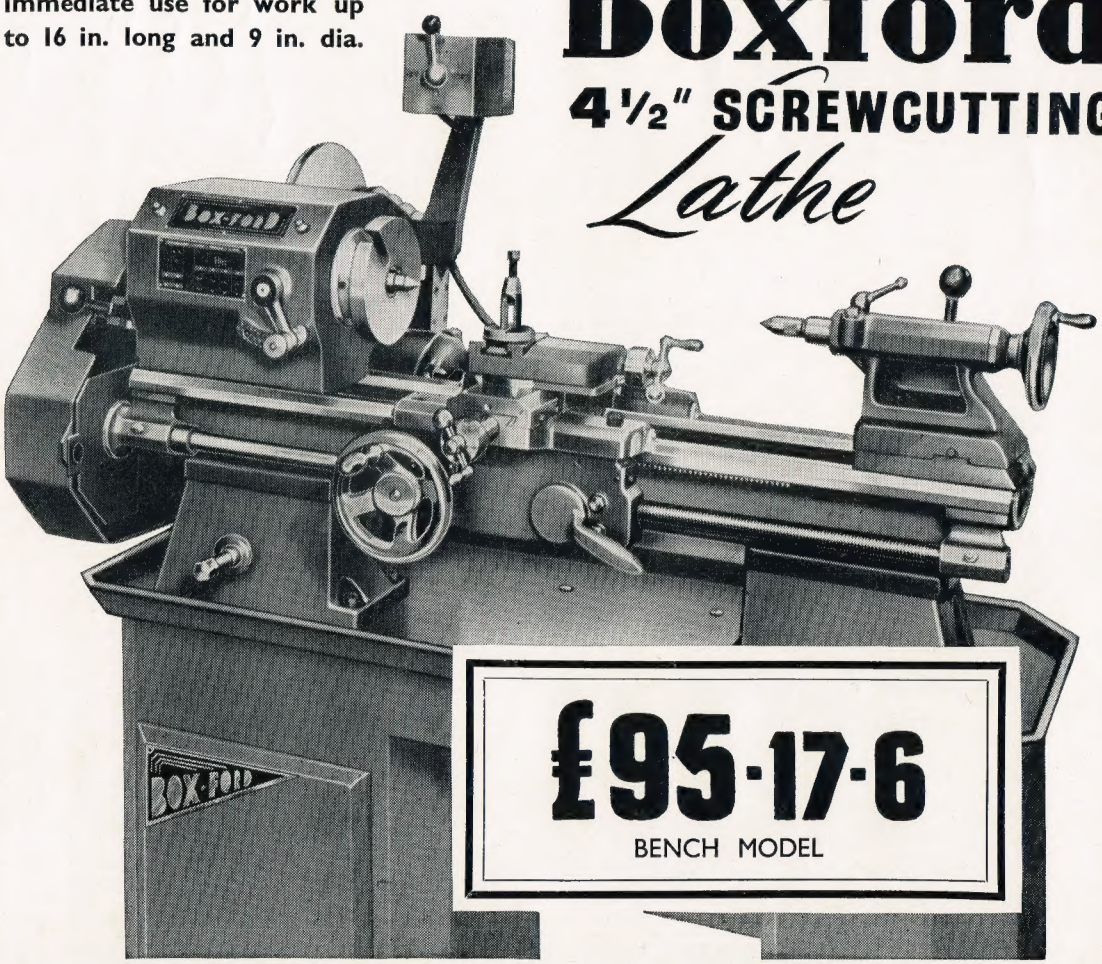

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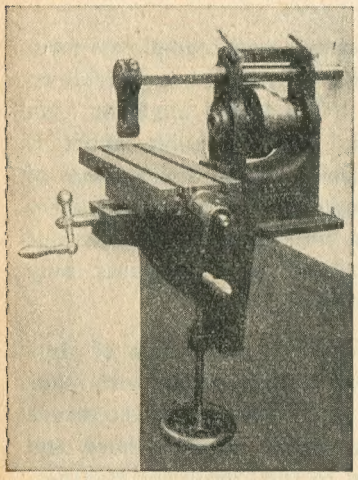

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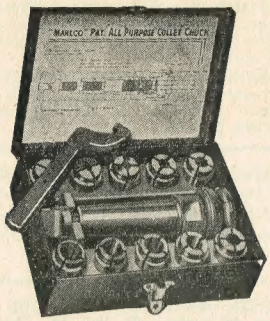

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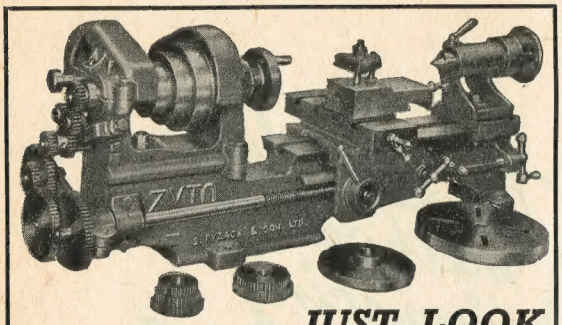

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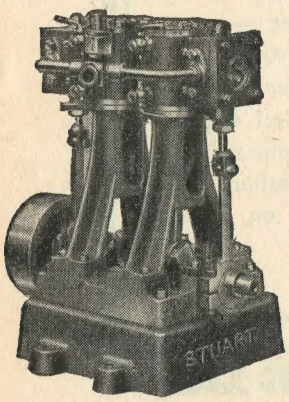

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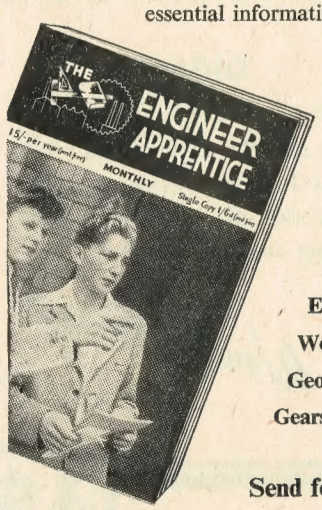

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THE MODEL ENGINEER

EVERY THURSDAY

Volume 110 - No. 2765

MAY 20th 1954

ESTABLISHED 1898

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Our Cover Picture

A close-up photograph of a model is frequently an excellent test of its authentic appearance, but the model shown on this week's cover passes the test very well indeed. The photograph was taken by "Northerner" at the recent Northern Models Exhibition, and shows the motor salvage tug *Dolphin* built by J. Bowness of Stockport.

As will be seen, the builder has incorporated a great deal of detail, and this is well carried out. As a point of interest, the chart-table on the bridge carries under its glass surface a "chart" of the water where Mr. Bowness sails the model.

The vessel is propelled by a 10-volt electric motor, and will tow a rowing-boat with two passengers at a good speed. Readers desirous of building a similar model should note, by the way, that it was built from drawings obtainable from this office.

SMOKE RINGS

That Latin Phrase

MR. M. LAWSON FINCH'S letter in our April 29th, issue attracted quite a lot of attention; we rather thought that it would. The Latin phrase, "Astra castra, Numen lumen" seems to have been widely known years ago. Perhaps the best, if somewhat loose rendering into English is: "The stars, my camp; God, my lamp." The "young lady still at school," referred to by Mr. Finch, had certainly got the literal meanings of the Latin words; but she had failed to discover the actual significance of them. The many readers who sent in the information quoted are thanked for their help and interest.

The Horsham M.E. Exhibition

MODEL ENGINEERS in the Horsham district have at least one of the most important qualifications for success in their club activities, namely, perseverance. After having made a determined attempt to organise a club in 1946, which failed mainly through lack of facilities in this difficult period, they got together last year, and with the prospect of better support from local authorities, succeeded in forming a new club in the autumn. They have now been able to organise a very creditable exhibition, in which a very wide variety of models and other handicraft work, much of it of considerable merit, was displayed. The model aircraft section was particularly well represented, including radio control and at least one example of a successful home-built diesel engine. Several locomotives are in course of construction, and a rather unusual exhibit in this section was a non-working model tank loco in 3½ in. gauge, which nevertheless contained working controls, including brakes; its construction, originally undertaken with the idea of making a simple toy, is entirely from scrap material. Several ship models, yachts and model power boats were exhibited, the latter with various forms of power plant, including some ingenious steam engines. The local secondary school had a stand displaying some excellent examples of work by pupils, and in the handicrafts section, the contribution made by the ladies deserved special mention.

We learn the the Horsham U.D.C. has taken a great interest in the club and has granted facilities for building a track, also for converting a disused building into a club house and workshop.

A New B.R. Training School

FOLLOWING UPON the success of the Training School at Derby locomotive works, British Railways, London Midland Region, recently referred to in this column, a similar establishment has lately been inaugurated at the carriage and wagon works at Wolverton. A former laundry for linen used in sleeping cars and dining cars has been converted into a first-class school which comprises a large workshop on the ground floor, and two spacious lecture rooms, an instructors' room and a cinematograph projection room on the first floor. One of the lecture rooms is fitted with a science desk to facilitate practical demonstrations and experimental work.

The layout of the accommodation is planned for upwards of 90 to 100 apprentice trainees at any time, the intakes of whom will conform to the leaving duties of the schools in the Wolverton area and will be three per annum. Consequently, one third of the total annual requirements of the works will be started each school term.

Every sort of craft that will be required in the works is, of course, included in the school curriculum.

This idea of providing apprentice training schools at various railway centres is to be developed and extended, and it is worthy of note that County Education Committees in various areas are co-operating whole-heartedly.

Inter-Club Circuit Racing in London

Reported by

Geoffrey Deason

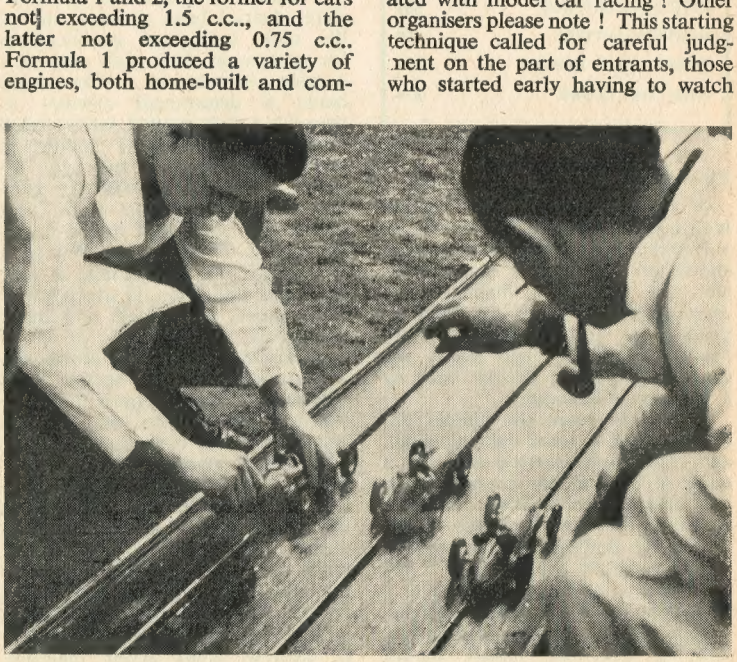
Start of a Formula 1 *heat*

THE Miniature Motor Sport Club proved to be a happy title for the group of London enthusiasts who staged their first inter-club circuit races at Hanworth on a recent Sunday. The hosts of the occasion were the model car section of Messrs Evershed's Social and Athletic Association, on whose pleasant sports ground at Boston Manor the M.M.S.C. track was erected. This is a three-rail circuit, measuring 130 feet on the centre rail, roughly " B " shaped, with a rising gradient at the end of the long straight and a run downhill through the twisty back stretch, providing four right and one left-hand curves of varying severity. A hard-board surface is used and the starts are controlled by the usual track-side operated stops.

Lap-scoring

This was simple but efficient. A lap-scorer was responsible for each rail, these being designated red, green, and yellow. Each rail had its corresponding indicator with large dial graduated in laps, the pointer of which was operated by electrical impulse from a remote push-button held by the lap-scorer concerned. It was thus possible to follow the progress of any race by a quick glance at the easily-read dials, a feature which added considerably to onlookers' interest, and in part at least compensated for the lack of a p.a. system. A well-produced programme was provided, which really did contain full details of the very creditable entry of twenty-five cars ; these were representative of four clubs, Portsmouth M.C.C., North London S.M.E., the Miniature Motor Sport Club and Evershed's M.C. Section.

Racing events were divided into Formula 1 and 2, the former for cars not exceeding 1.5 c.c.., and the latter not exceeding 0.75 c.c.. Formula 1 produced a variety of engines, both home-built and commercial, whilst the Formula 2 supporters relied on the popular Mills .75 to a man ! Promptly on schedule, the Formula 2 event got under way, this being arranged on a " tournament " basis, in which each car met every other car once, in three-car 10 lap races. Three, two and one point markings were awarded for first, second and third places. A " one-minute " starting bell was rung before each race, the final ten seconds being counted aloud by the starter, and the inflexible application of this rule led to a marked degree of attention being paid to it by the competitors, and a greatly improved standard of reliability over that usually associated with model car racing ! Other organisers please note ! This starting technique called for careful judgment on the part of entrants, those who started early having to watch



Two cars away in the Formula 2 *event, whilst adjustments continue on the outside model*

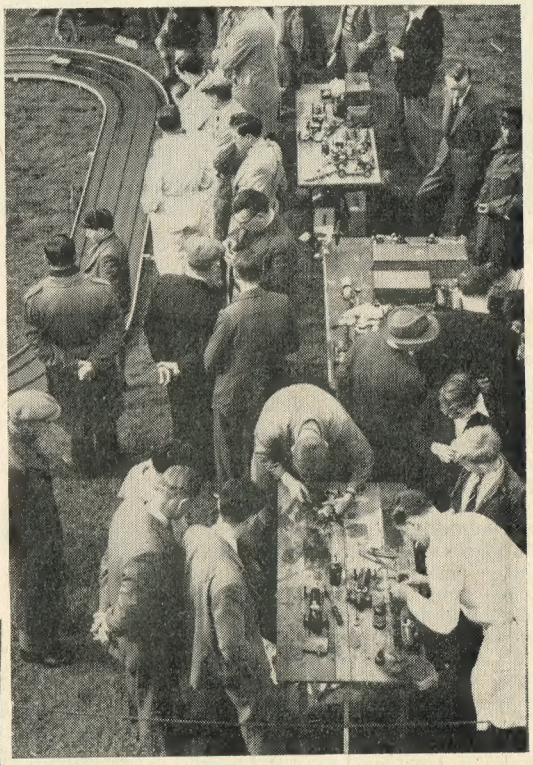
their cars overheating their clutches merrily as they waited against the stop for the "Off," whilst the laggards were mercilessly left behind. In order to counter the slight variation in lap distances between the rails, cars started at three-second intervals in Formula 2, and the larger class at two second intervals. This appeared to level things off quite satisfactorily, all races being over 10 laps.

The models varied considerably as to workmanship and finish, from the trim and realistic to the frankly scruffy. D. Roskilly's and S. Westoll's Maserati's were good examples of Formula 2, whilst of the 1.5 c.c. cars, Arthur Weaver's freelance "Yellow Peril," W. Chandler's wire-wheeled Talbot, and W. Ransoms' "Trimax" looked particularly nice in action. For sheer eye-appeal, however, A. E. Dowell's XK 120 Jaguar (seen at last year's "M.E." Exhibition) took the honours, and its silent performance was really fascinating. This model is fitted with an efficient silencing system with ring manifold and authentic twin tail pipes, to which the E.D. Bee appears to take no sort of exception. Several interesting models in part-finished state were also on view in the "paddock," notably W. Ransom's Aston Martin D.B.2, the strictly scale body of which is carved from obechi, with neatly inset mahogany roof pillars. A super finish is planned, the colour-scheme chosen being pale metallic blue with red leather upholstery.

Reverting to the racing, the first race was won by S. Westoll's nice Maserati from D. Blackshire's Ferrari, the latter model managing a spectacular dead-heat for second place with D. Roskilly's Maserati in race 2, a highly lively affair, which was won by F. Thomas's ex-Roskilly "Black Bess" in the best time recorded in the Formula 2 event of 1 min. 26 secs. The Maserati had an easy win in the next round, its opponents failing to complete the course. B. Stocker's "Stocker Special" took the next heat, which was followed by two good wins in succession by "Black Bess," the reliability of which has been proved over several seasons' running. The Stocker Special again led the final round, resulting in an overall points lead for F. Thomas's "Black Bess," with three wins in the seven races, a performance which netted the Chinn Trophy.

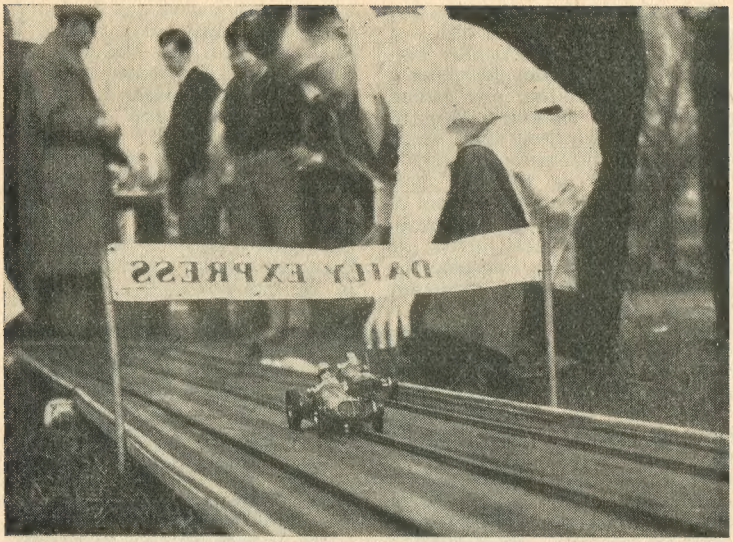
Formula 1, for the M.M.S.C. Cup was run on a knockout basis. with the Final including the two winning semi-finalists and the fastest losing semi-finalist. Arthur Weaver's M.G. won Heat 1, B. Hammersley's B.R.M. (E.D. Bee) scored again for North London in Heat 2, and the Weaver "Yellow Peril" completed the hat-trick in the next bout. A. E. Dowell's Alfa Romeo (E.D. Bee) and Chris Thorp's old "North London Special" continued the good work, although P. Bailey's Alfa Romeo struck a blow for the Portsmouth club by taking heat six. In the semi-finals, alas, he lost his place to C. Thorp's special in a race won in one minute dead (a race average of 14 m.p.h.), a time also clocked by "Yellow Peril," both cars being powered by 1 c.c. home-built engines Thus it was an all-North London Final, a result probably reflecting the considerable amount of track experience amassed by this keen club.

After a period of tea-drinking in the clubhouse, and a welcome cooling down of overheated engines and clutches, the finalists came to the start, which was not without excitement ! Hot favourite Arthur



A bird's eye view of lively activity in the pits, with a race in progress

Lap-scorers at work, with the individual lap-counting dials in the background



Fighting finish to a Formula 2 race. S. Westoll's Maserati wins, as second man D. Blackshire trips the cut-off of his Ferrari

Weaver came unstuck as the last seconds were counted off, his engine stalling on the line. The two others got away nicely, Thorp's tiny cast-body car building up a steady lead, whilst furious activity got the "Yellow Peril" restarted on what appeared to be a very forlorn chase. The Dowell Alfa Romeo (E.D. Bee) meanwhile piled up laps steadily, but was lapped by the "Peril," which tore through in magnificent style. With three laps to go however, the Thorp N.L. Special suddenly expired, and despite being restarted in record time, was overtaken within sight of the finish by the "Yellow Peril," which won in 1 minute 6 seconds, a fine time in view of its delayed start.

After this excitement had died down, a nice sight was the Dowell Jaguar, complete with neatly vizored driver and passenger seat tonneau cover, purring silently round to "close the course" in true official style, following which the cups were presented and the track was thrown open to all car owners for general running.

Experience Counts!

To sum up a pleasant afternoon's activities, it would seem that reliability and knowledgeable handling are still the prime factors of success in circuit racing, and that on small and "tricky" courses, the 1 c.c. engine, in a soundly constructed car, can hold its own against those of "top limit" capacity. A. F. Weaver's "Yellow Peril" is a beautifully built little car of pleasing appearance, powered by a comparatively long-stroke engine, fitted horizontally in the frame, driving through a conventional propeller shaft and bevel gearing. F. Thomas's Formula 2 winner is the essence of simplicity, with clutch and drive wheel mounted on the engine shaft. Several Formula 1 cars were using engines such as the early Mills 1.3 c.c. job, and putting up a good show with them, a fact which should encourage more owners of typically modest power-units to "have a go." Swivel-action steering was used by both winners, although users of fixed rollers appeared to be at little or no disadvantage. A pleasing feature of the entry was the inclusion of miniature "drivers" in most cars, a small point which, as model aircraft team-racers well know, adds considerably to the air of realism.

The organising clubs are certainly to be congratulated on their enterprise, particularly in view of the disappointment caused by the fiasco of the M.G. Trophy, and it will be a valuable fillip to the movement generally if more such inter-club meetings are held during the summer. Interested owners and would-be builders of circuit-racing models in the London area should write to D. J. Roskilly, Hon. Sec., Miniature Motor Sport Club, 58, Beaufort Road, Ham, Surrey, or to Chris Thorp, 94, Braemar Avenue, Neasden, N.W.10.

Who's Who IN MODEL ENGINEERING

C. M. KEILLER

A versatile craftsman in many branches of engineering, Mr. Keiller is chiefly noted for his work in the construction and experimental development of steam-driven model locomotives. He was born at Wimbledon Park, London, in 1888, and educated at Mill Hill School, Northern Polytechnic, Holloway, and Great Western Works, Swindon.

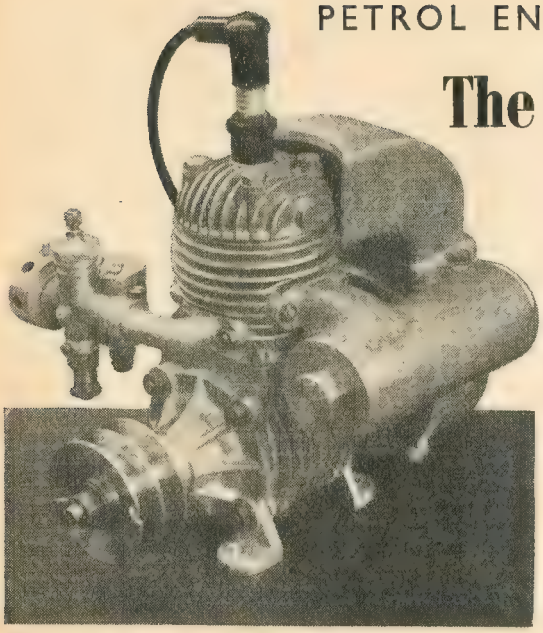
His model activities date from before the beginning of the present century, and he has also been professionally connected with automobile manufacture, being one of the founder members of G. W. K. Cars in 1911. At present he has a fleet of eight model locomotives in ½-in. scale, and two of his models, namely the Great Western Railway "Duke of Connaught" and L.M.S. standard compound, won silver medals in the Model Engineer Exhibitions of 1928 and 1937 respectively. In addition to model engineering, he has a keen interest in firearms mainly sporting rifles, and similar guns.

PETROL ENGINE TOPICS

The 50 c.c. "BUMBLE BEE"

A NEW DEVELOPMENT OF THE "BUSY BEE" AUXILIARY ENGINE INTENDED PRIMARILY FOR STATIONARY WORK

By Edgar T. Westbury



The "Bumble Bee" engine from the power take-off end

SINCE the original "Busy Bee" engine was described in 1951, there have been many engines of this type constructed by readers in this country and abroad, either more or less exactly to the published design, or with various modifications by constructors. They have been applied not only to the purpose of propelling pedal cycles, but also to many other duties, including lawn mowers and stationary plant, and in at least one case, as the power unit for a passenger-hauling model locomotive—a sphere of action for which I should hesitate to say that it was inherently suited, though the constructor seems to be quite well satisfied with its performance.

Nearly all the reports of engines built by readers have been favourable, and some really eulogistic, but I do not propose to bask in the sunshine of unsolicited testimonials, as the credit for such success is due to the constructors themselves. The finest design in the world is brought to nought if the practical work in its execution is imperfect; and in no kind of engineering work is this more true than in a petrol engine. The "Busy Bee" engine is just a straightforward little two-stroke designed for moderate performance and long working life, with features adapted to suit it to a more or less specialised purpose.

On several occasions I have been urged to publish details of various possible applications of this engine, with methods of installation, and any required modifications. It has been my intention to do so, but various other matters have prevented my getting down to it seriously, and if the old adage be true, this particular good intention must have become yet another flagstone of that remarkably well-paved road to perdition! There are, however, several difficulties in producing exact plans to meet the very widely varied requirements of readers who wish to adapt the engine to special purposes. For instance, the application of the engine to a lawn mower is complicated by the differences in various makes of these machines, despite their similarity of appearance; in some of them, it is very difficult to find a place for fitting any means of power drive to the cutter cylinder.

Generally speaking, however, the "Busy Bee" engine can be applied to jobs of this nature with no alteration to the engine itself, and using the friction drive as a means of transmission to a rubber-tyred pulley on a countershaft, from which the final drive is taken by belt or chain to the cylinder. It may be found necessary to cut half-an-inch or so off one end of the cutting blades to make room for a pulley or sprocket, as fitting this outside the frames, even with the provision of a longer shaft, may be found impracticable. By means of lifting gear, as recommended for the cycle installation, the drive can be engaged or disconnected as readily as with a friction clutch. This method involves the minimum of attachments to the mower, as both the engine and countershaft can be mounted across the single or double handle.

Stationary Purposes

Within the last two or three years, many readers have asked for modifications to the engine to adapt it more particularly to what may be termed orthodox stationary work. These involve some means of mounting the engine directly on a flat base, without the need for additional bearers or cradle plates, and also provision for power take-off at the end remote from the flywheel. Incidental requirements which arise in connection with this duty include a means of providing forced draught cooling, adaptability for either horizontal or vertical mounting, and modifications to inlet and exhaust fittings to suit these arrangements. Hence the "Bumble Bee" engine design illustrated here, which is identical with the "Busy Bee" in its internal design, yet completely metamorphosed externally, as may be seen from the photograph.

I would like to make it clear that this design is not intended to "supersede" the "Busy Bee," though it is not denied that there is a case for minor revision of the latter design, with improvements to bring it fully up-to-date, and I intend to put this in hand as soon as possible. In the design shown here, I have taken into account all the points which have been raised by readers regarding the limitations of the original engine, in its application to stationary work only. Some constructors, for instance, have attempted to take a drive off the flywheel end of the engine, either by belt, chain, or direct-coupling, and

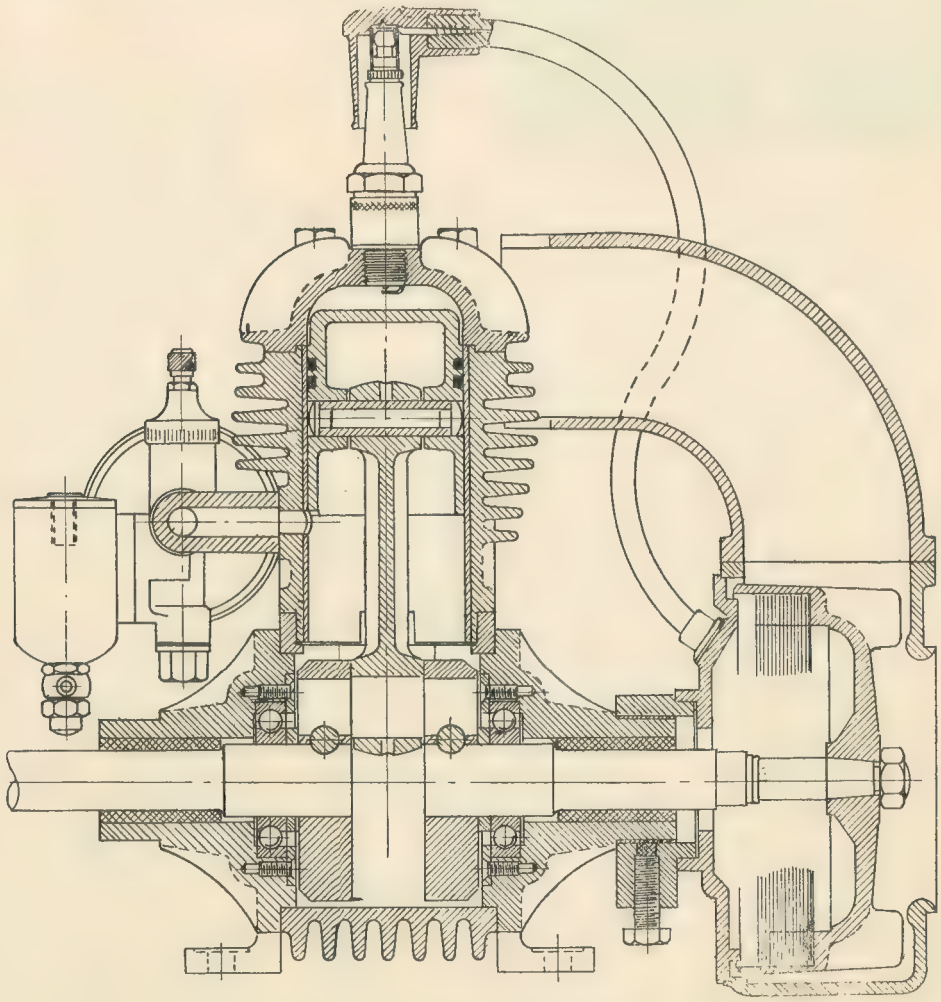
have found difficulties in this respect, due to inherent weakness of the shaft at this end.

It is rather unfortunate, from our point of view, that the only flywheel magnetos available commercially for these small engines have such a small bore for mounting, and also involve a relatively long shaft overhang, of inevitably small diameter, beyond the nearest main bearing. This makes the shaft weak to resist either direct torque or side thrust at the extended end, and there is nothing that can be done about it except fit a different flywheel, such as that of the magneto in my design, published in 1952 (Oct. to Dec.), or a plain flywheel, for use in conjunction with coil ignition or separate magneto; both the latter, however, involve some disadvantages or inconvenience.

I must apologise to readers for the delay in finalising the development of the " Bumble Bee " design, which was first introduced by Messrs. Braid Bros. in their display exhibit at last year's " M.E." Exhibition. The fact is that one or two experimental features in the design have taken longer to work out than was expected ; their ultimate success was never in any doubt, but the point at issue was finding the simplest and most satisfactory solution to constructional problems.

Crankshaft Design

One of these problems concerned the design of the crankshaft, which apart from the fact that it had to be double-ended in this case, had always been a bone of contention among some of the critics of the original " Busy Bee " engine. The overhung crankshaft of the latter was shown on the drawings as made in two pieces, namely the main shaft journal, and the web integral with crankpin and balance weight. A fair amount of machining is involved in making the latter part from the solid, though the alternative method of fabrication by brazing is practicable; some constructors made the web and balance weight in one piece, but with a separate crankpin, fitted by pressing into the web, which is perfectly satisfactory

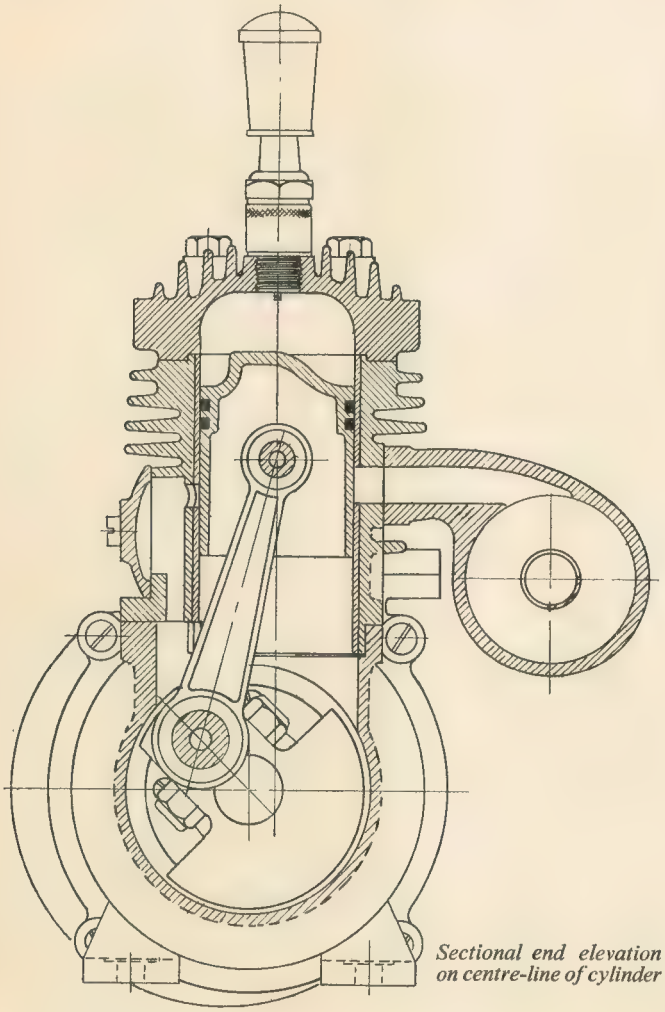


Sectional side elevation on centre-line of shaft

if properly carried out. There are, however, many pitfalls for the unwary in using press fits for highly stressed parts, and having seen the unfortunate results in several cases, I have hesitated to recommend this method for petrol engine crankshafts.

Some people object to overhung crankshafts on general mechanical principles, and it must be admitted that they look very unscientific in comparison with cranks supported by main bearings at both ends. But in actual fact, a properly designed overhung crank, of inherent rigidity, ample effective main bearing length, and minimum length of overhang from the main bearing, is not only less subject to load deflection than the orthodox type of " full " crank, but also less affected by deflection of the entire engine structure. The highest mechanical efficiency under working conditions has been attained by engines having overhung crankshafts.

However, in the case of the " Bumble Bee " engine, it was necessary to have a main shaft extending at both ends of the crank case, so an orthodox form of full crankshaft seemed, on the face of it, to be the simplest solution. But such a crankshaft, if made in one piece or permanently fabricated, involved the need for some form of divided bearing for the big-end of the connecting-rod; and having experienced innumerable troubles in the past with small split bearings on high-speed enclosed engines, I was reluctant to use this type here, even if room could be spared for the increased size of such a bearing, and its bolts, in the crankcase, without lowering pumping efficiency. Moreover, the machining of a full crankshaft of this size is quite an undertaking, under the limitations of available equipment in the home workshop; certainly it can be done, with care and patience, but many constructors would find it tedious, and by no means simple or straightforward. No matter what methods are employed, it must necessarily involve much more work than a simple overhung crankshaft.



Sectional end elevation on centre-line of cylinder

A type of crankshaft which I have used several times before, and for which I have more than a sneaking regard, is that in which one of the main journals, with the web and the crankpin, are integral, but the other web and main journal are detachable, and may not necessarily be rigidly connected at all. In other words, this assembly may be described as an overhung crankshaft with a follower crank. Many students of engineering design do not share my approval of this type, which they consider to be weak in comparison with a complete one-piece shaft, but it has been perfectly successful on several of my engines which have had very heavy use, not to mention abuse as well. It has an advantage over the simple overhung crank, in giving some outboard support to the end of the crankpin, while being to some extent self-articulating to take up minor alignment errors, either transient or permanent, and it is immune from distortion by wrenching, which often occurs in solid crankshafts by excessive torque loading.

An Unsuccessful Experiment

It was still very desirable to reduce the amount of spade work involved in machining the crankshaft components, and it would have been very nice if forgings could have been produced, having nothing more than machining allowance for turning the journals and crankpin. This simple solution was, however, ruled out on grounds of economics, bearing in mind that large quantity production was never contemplated. There was, however, another possible solution. It is well known that due to modern methods in the control of quality and heating processes in smelting, it is possible to produce cast-iron of very high tensile strength, suitable for highly stressed engine parts; the best-known and most

widely-applied product of this nature is known as Meehanite, which is made under licence by several foundries in this country, and is used, among other purposes, for making crankshafts for many types of engines, including some of fairly high performance. Through the good offices of one of my friends in the industry, I was able to get some samples of crankshaft castings from my own patterns in this material.

These castings were duly machined and tested out, but I am very sorry to report that the results were disappointing; I hasten to add, however, that this was not due to inherent unsuitability of the material, or its application to the design, but simply because of the necessity for using a small diameter at the end of the shaft for the magneto fitting. The successful use of Meehanite for these purposes demands that an ample section of metal should be provided, and in practice, crankshafts of this material are usually made of large diameter with the centre cored out. There would, I feel quite sure, have been no trouble with the main journals and crankpin, which are well on the large side in this engine, but the small diameter at the magneto end, and particularly the thread at the end, which could not be made larger than $\frac{5}{16}$ in. diameter, were definitely too weak.

After spending a good deal of time on this experiment, I was obliged to revert to the use of more conventional material; but still in the quest for simplified machining, I decided to use a completely built-up assembly, using plain turned shafts, and webs made from mild-steel blanks, clamped and keyed to the shafts by methods which ensure perfect alignment and rigidity, as will be described in due course. In deference to the wishes of prospective constructors who insisted that a rigid assembly was necessary, I have provided for this, but I am prepared to guarantee that the shaft will be equally satisfactory if one end of the crankpin is left loose, so long as it is a good fit in the web; the rigid fixing should always be on the flywheel side.

It is necessary that the crankshaft should be assembled after the connecting-rod has been inserted in the crankcase barrel; thus any form of crankshaft which involves the need for careful lining-up on assembly would not be easy to fit. The use of a crankcase split on the vertical transverse centre-line would simplify this, but there are quite a few snags in this form of construction, despite its popularity, and moreover, it would not allow of adapting the engine to either vertical or horizontal mounting, unless separate bearers or cradle plates were provided.

Castings

A good deal of pains have been taken to obtain really good castings for this engine, and thanks to the efforts of Braid Bros., who have been most co-operative over all aspects of the development work, it can be claimed that the quality and soundness of all materials are of an order well above the average of that generally available to amateur constructors. Where special detail and accuracy are required, gravity die castings are used; the finned cylinder-head is the same as that which has for some time been available for the "Busy Bee" and is not altered in any respect, though in machining, the need for fitting a decompressor is eliminated where the engine is used for stationary work.

It is in connection with the cylinder casting that the greatest problems have arisen. The iron casting for the "Busy Bee" was generally satisfactory, though good sound castings in this material are by no means easy to obtain, and it was necessary to restrict the depth and number of cooling fins to get them cast at all. The machining of an iron casting of large size is a heavy operation for a small lathe. Many manufacturers of motor-cycle and other air-cooled engines have adopted a form of cylinder which has long been known to amateurs, and which I may claim to have pioneered in the original "Atom Minor" 15 c.c. engine produced in 1932; namely, an aluminium shroud or jacket casting with an inserted iron or steel liner. This enables a greater area of casting surface, in a material of higher heat conductivity to be employed.

The fitting of such a liner, however, is not as easy as it seems, and troubles such as faulty heat conduction at the junction of the two metals, and distortion through unequal expansion, are not uncommon. To the amateur constructor, the need for extra work, in the internal and external machining of the liner, and the boring of the aluminium shroud, constitute an objection to this form of construction.

In the most up-to-date development of the bi-metal cylinder, the liners are cast in by a patented process in which the aluminium alloy amalgamates with, or fuses to, the surface of the ferrous liner to form a perfect metallic bond. Here again, I can claim pioneer development work as I experimented with such a process for several years before the war (though it did not occur to me that it was patentable !), and thanks to the help of Mr. L. D. Johnson, of Birmingham, I was able to specify it for the "Ensign" 10 c.c. engine in 1946.

A similar method is now used for the cylinders of both the "Bees," but it should not be thought that it was evolved without a considerable amount of spade work, with a good many disappointments, and many modifications to dies, before the desired results were obtained. The liners are made from solid drawn chrome molybdenum steel tube, which is accurate internally to within one or two thousandths of an inch, and needs only to be lapped to produce the final finish. Thus the work of the constructor is considerably reduced, both in quantity and difficulty.

Cooling and Silencing

As already mentioned, forced draught cooling is desirable, if not absolutely necessary, on an air-cooled stationary engine, and is provided in this case by means of a centrifugal fan on the flywheel magneto, in conjunction with a cast volute surrounding the latter, and an air duct leading to an outlet which directs the air on to the cylinder-head. It has been found that in a small two-stroke engine, it is desirable to keep the crankcase as cool as possible to avoid rarefying the mixture before transfer to the cylinder, and thus the finning of both the barrel and the housing endplates has a beneficial effect.

The type of silencer recommended for the "Busy Bee" engine can be used for the stationary version in certain cases, but generally, it will be more convenient to use the one shown in the drawings herewith, which is of a different shape, but works on the same principle, namely, the formation of a vortex by tangential entry and rotary flow of the gases, thereby lowering the pressure at the central outlet. A tail pipe can be fitted to lead the exhaust wherever required, and for permanent installations, it is recommended that an extra expansion chamber of large area should be fitted in series, preferably below ground level, to suppress the noise effectively.

The power of this engine is rated at $\frac{1}{2}$ h.p. for continuous working at speeds from 2,500 to 3,000 r.p.m.; though it is capable of higher speed and power, it is not desirable to force the pace of any stationary engine if it is expected to have a long and reliable working life.

(To be continued)

L.B.S.C.'s Titfield Thunderbolt

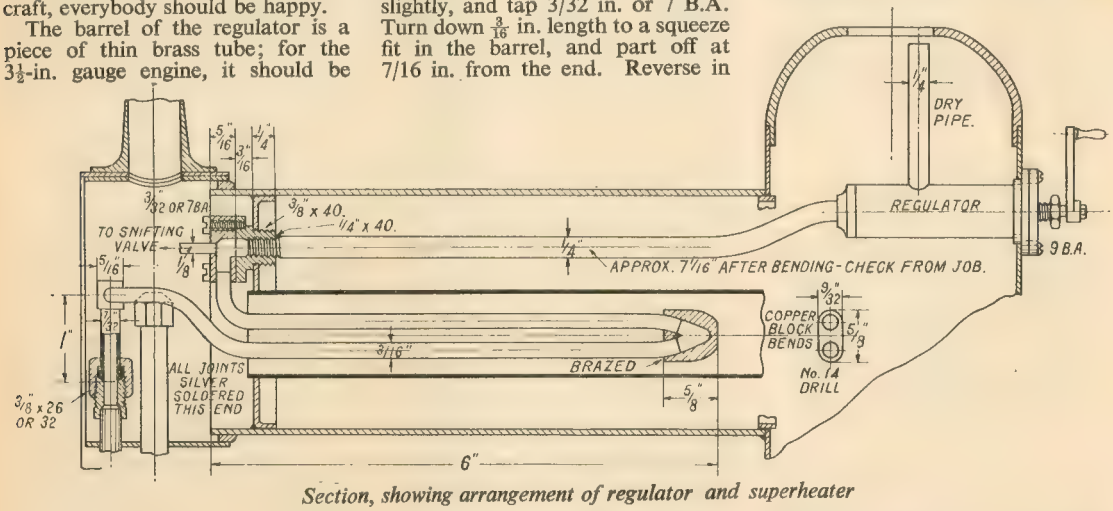
REGULATOR AND SUPERHEATER DETAILS

AT the time the *Tit* was built, the most common form of regulator used in boilers with haystack or Gothic fireboxes, was a slotted disc working over a similar portface, enclosed in a circular casing, which was surmounted by a trumpet-shaped pipe, sometimes curved, leading to the top of the dome. I am therefore specifying its small relation, my pet disc-in-a-tube, for the little engines, with a steam pipe attached to the top, to take steam from the top of the dome. The construction of this has already been described many times in these notes; so if I run briefly through, for the benefit of newcomers to our craft, everybody should be happy.

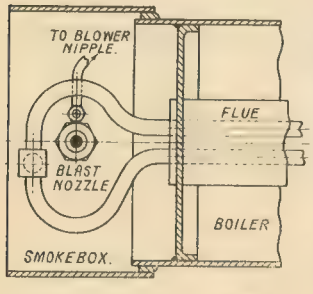
The barrel of the regulator is a piece of thin brass tube; for the 3½-in. gauge engine, it should be ⅝ in. diameter, and 2 in. long after squaring off the end. To provide a hold for the threads of the vertical steam pipe, a bush will be required. Chuck a piece of ⅝-in. round brass rod in the three-jaw, turn down about ⅝ in. length to a tight fit in the barrel, and part off at a full ½ in. from the end. Rechuck, centre, and drill right through with an 11/32-in. drill. Skim both ends true, and press it into the barrel, so that the centre of it is ¾ in. from one end.

The throttle block should be turned from ⅝-in. round bronze or gunmetal rod held in three-jaw. Face the end, centre, drill about ⅛ in. depth with No. 48 drill, countersink slightly, and tap 3/32 in. or 7 B.A. Turn down 3/16 in. length to a squeeze fit in the barrel, and part off at 7/16 in. from the end. Reverse in chuck, turn outside to shape shown, centre, drill 7/32 in. for a full ¼ in. depth, and tap ¼ in. × 40 for the steam pipe. Mark out the ports as shown in the detail drawing, centre-pop, and drill them in, on the slant, so that they break into the steam pipe hole, as shown in the section. At ⅛ in. off centre line, close to the edge near the bottom, drill a No. 55 hole and tap it 1/16 in. or 10 B.A. for the stop-pin. Anybody who wants to put a great ugly quadrant stop on the backhead, is, of course, at liberty to do so, in place of the pin; but such stops give me the proverbial "pain in the neck"! Both pivot-pin and stop-pin are made from bronze wire or rod, and need no describing, but don't screw them in "for keeps" until you are ready to assemble the whole bag of tricks.

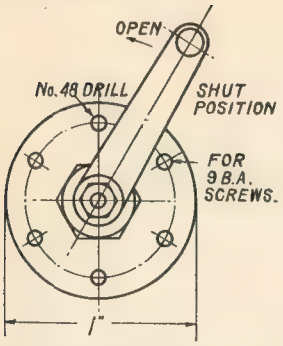
The valve should, by the good rights, be turned from a different grade of metal from the port-face; a bit of cast bronze or gunmetal would be just the identical, or hard brass would do. Chuck in three-jaw, and face the end; turn down 3/16 in. length to a full 3/16 in. diameter, and part off at ⅛ in. from the shoulder. Reverse in chuck, and carefully face the contact side. Centre, drill a full ⅛ in. depth with No. 40 drill, and countersink slightly. The boss can be slotted with hacksaw and fine flat file, if you can't mill it. Incidentally, for many years I used an old self-centring three-jaw chuck, minus backplate, as a machine-vice for holding round work endwise on the drilling-machine table, and for bench work. A peg in the bench, fitting the hole in the chuck, prevented movement when operating with hacksaw and file, as above. True up the port-face and the valve-face on a bit of fine emerycloth laid on a flat surface, rubbing carefully with



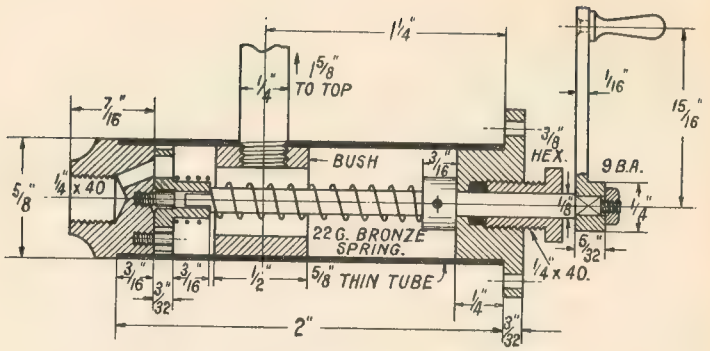
Section, showing arrangement of regulator and superheater



Plan of superheater connections



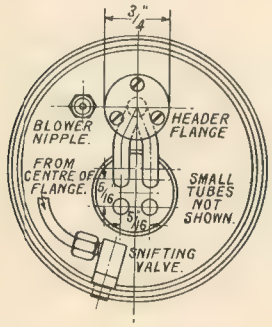
Regulator flange and gland



Section of regulator —3½ in. gauge engine

a circular motion, and put in the pins, just fingertight, to avoid losing them.

The flanged fitting which carries the gland, can be made from a casting, or turned from 1-in. rod, held in three-jaw. Face the end, centre, and drill down a full ⅜ in. depth with No. 30 drill. Turn down ¼ in. of the end to a tight fit in the regulator barrel, and part off at ⅛ in. from the shoulder. Reverse in chuck, skim face true, open out centre hole for 9/32 in. depth with 7/32 in. drill, and tap ¼ in. × 40. The gland is made from ⅜ in. hexagon rod, and needs no detailing. Drill six No. 48 screw-holes, as shown in the end view.



Connections at front end

The rod is a piece of ⅛-in. round bronze, or rustless steel, a full 2¼ in. long. One end is filed each side to form a flat tongue a full ⅛ in. long, to fit easily in the slot in the back of the valve. The other end is turned down to 5/64 in. diameter for a bare ⅛ in. length, and screwed 9 B.A. The next ⅛ in. is filed square; for beginners' benefit, hold in three-jaw with that much projecting. Set one chuck jaw vertical, and with a safe-edge file, file a flat on the rod, taking care to avoid filing the threaded part. Repeat filing operation with the chuck jaw at 3, 6 and 9 o'clock positions, and there's your square, all-present-and-correct-sergeant. Chuck a bit of ¼-in. round rod, centre, drill down for ¼ in. depth with No. 32 drill, and part off a 3/16-in. slice. Press this on to the rod so that it is approximately 1¼ in. from the flattened end.

Put a spot of oil on the port-face and valve-face, check for opening and closing (if ports don't open fully, file the clearance in the valve a little longer) and check for tightness by sucking at the tapped hole. If you can draw air through, the faces need another rub or so on the emery-cloth. If O.K. screw the pins in tightly, put the valve on, and push the lot into the barrel. Push the short end of the rod through the gland fitting, then insert into barrel, with the tongue in the slot in valve, and push gland fitting right home. There should then be about 1/32 in. end play on the rod. If more, or less, the collar wants adjusting on the rod. When you get it right, pin the collar to the rod; then, at the top of barrel, 1¼ in. from the gland end, drill a 7/32-in. hole, and tap it ¼ in × 40, for the vertical steam pipe. Be sure all the chippings are cleaned out; then assemble the regulator as shown, putting a 22-gauge spring made from hard bronze or brass wire, around the rod, to press against valve and collar. This keeps the valve on its face when there is no steam in the boiler, preventing any grit or scale getting between the faces if the engine is turned upside down for any purpose. Don't forget a spot of cylinder oil on the port-face; the gland can be packed with a few strands of graphited yarn.

The handle can be made exactly as I have described for making bossed valve-gear levers, from 1/16-in. steel strip filed to shape, with a boss brazed on. The hole is first drilled 3/32 in. or No. 41, and a square drift made from a bit of 3/32 in. square silver-steel, driven through it. The grip is turned from ⅛ in. round rod, leaving a pip on the flanged end, which is driven into a 1/16 in. hole drilled in the end of the handle, and riveted over. The complete handle is attached to the rod by a commercial 9-B.A. nut. Warning—when punching the square hole in the boss, have the regulator in the shut position, and punch the hole to suit the square, with the handle in the position shown in the end view, inclining about 30 deg. to the right, otherwise, the driver won't know whether he is starting or stopping ! A similar inclination to the left, should open the port fully. The vertical steam pipe is just a 1¾ in. length of ¼-in. pipe with a few ¼-in. × 40 threads on one end. It cannot be screwed into the barrel until the regulator is erected.

Main Steam Pipe and Flange

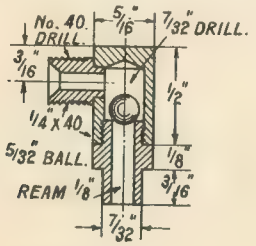
The main steam pipe is made from ¼-in. copper tube, not less than 20-gauge, and is offset at the firebox end to about 7/16 in. as shown. The length after offsetting, should be approximately 7 1/16 in. Each end is screwed ¼ in. × 40, and the offset end screwed into the throttle-block with a smear of plumbers' jointing on the threads.

The steam flange can be turned from ¾-in. round or hexagon brass rod held in three-jaw. Face the end, centre, drill down ½ in. depth with 7/32 in. drill, and tap ¼ in. × 40. Turn down ¼ in. of the outside to ⅜ in. diameter, and screw ⅜ in. × 40. Reduce the next 1/16 in. to ½ in. diameter, and part off at ⅛ in. from the shoulder. Reverse in chuck, and take a skim off the contact face to true it.

Put the regulator assembly in place, with the steam pipe just showing through the hole in the smokebox tubeplate. Hold the flange tight against the backhead bush, run the 48 drill through screw-holes, making countersinks on the bush, remove regulator, drill countersinks No. 53, tap 9 B.A.,

smooth off any burring, and replace regulator assembly with a 1/64-in. Hallite or similar jointing washer between the flange and bush. Secure with 9-B.A. round-head brass screws. Anoint the threads on the other end of the steam pipe with a taste of plumbers' jointing, also the external threads on the steam flange, and screw the latter on to the pipe; the outer threads will engage the tapped hole in the tubeplate, and lock the lot solid. Screw the vertical pipe into the regulator barrel, and another stage is completed.

The superheater is of the type that I first used on the rebuilt 2½-in. gauge *Cock-o'-the-North* about 12 years ago; two elements in a single flue. It made her step lively, so there isn't any reason to suppose that the effect will be any inferior on the *Tit*. Cut two pieces of $\frac{9}{16}$ in × 22-gauge copper tube about 6 in. long, and two more about 7½ in. long. Each block bend will need a piece of copper ⅝ in. square and 9/32 in. thick. Maybe our advertisers will supply cast bends. File to shape shown, and drill two No. 14 holes in each, so that they break into each other, as shown in section. Fit one long and one short element into each, and braze the joints, using



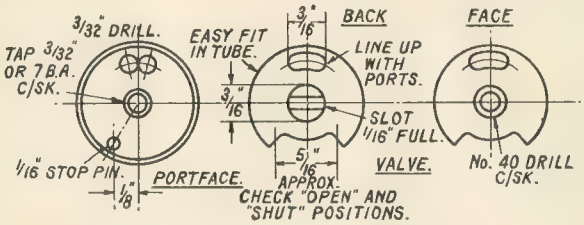
Snifting valve

brass wire or Sifbronze No. 1; don't use silver-solder at the firebox end, or you've had it. The harder material only needs a bright red heat instead of dull, the job is no more difficult. Soften the loose ends by heating with the blowpipe or lamp before pickling, after which they can be bent as shown in the sectional illustration. The shorter ends are turned upwards for attachment to the wet header, and the longer ones curved to represent the pair of pliers that the earwig always carries but (unlike the legendary plumber) never leaves behind.

The flange forming the wet header is just a $\frac{5}{16}$-in. slice of ¾-in. round rod. Chuck in three-jaw, centre, and drill a No. 32 hole right through; open out for $\frac{3}{16}$ in. depth with 7/32 in. drill, and skim the face true. Drill two No. 14 holes in the thickness, converging on the centre hole (see dotted lines in front view) and three No. 41 holes for the screws. Fit this to the bent-up ends of the shorter elements, and put a bit of ⅛-in. copper tube about 3 in. long in the front hole, for connecting to the snifting-valve. The other end of this is furnished with a ¼ in. × 40 union nut and cone.

Let the water run well through the elements, in case any scale has formed inside them. I usually give mine a good sluicing with a small hose connected to the domestic tap.

The superheater can then be erected, just by poking the elements into the flue, and attaching the wet header to the steam flange by three 3/32-in. or 7-B.A. screws, in a manner



Regulator port face and valve

Cut a little block of brass about $\frac{5}{16}$ in. square; drill a No. 14 hole clean through it, and a 7/32 in. or No. 3 hole in one of the other facets, breaking into the first hole. Fit the "earwig's tail" into the smaller holes in the block, as shown in plan. Chuck a bit of $\frac{5}{16}$-in. bronze or gunmetal rod in three-jaw (brass *will* do at a pinch, but the harder stuff is preferable for this) face the end, centre, and drill down about 1 in. depth with 5/32-in. or No. 21 drill. Turn down ⅜ in. of the outside to 7/32 in. diameter, and part off at 1 in. from the end. Reverse in chuck, and turn a cone on the other end, to the same angle as the lathe centre, or the coned part of a centre-drill. Make a union nut from $\frac{7}{16}$ in. hexagon rod (you should know how to do *that* job by this time !) slip it on the stem of the cone fitting, and squeeze the end into the 7/32 in. hole in the square block. The joints in this, and those where the pipes enter the wet header, can then be silver-soldered; simply anoint with wet flux, heat to dull red, touch joints with a strip of Easyflo or best grade silver-solder, let cool to black, pickle, and wash off.

similar, to the regulator flange. Put a 1/64-in. Hallite or similar jointing gasket between the contact faces, and don't forget to punch a hole in the middle, for steam to pass through ! Don't bother about the blastpipe or cylinder connections for the time being.

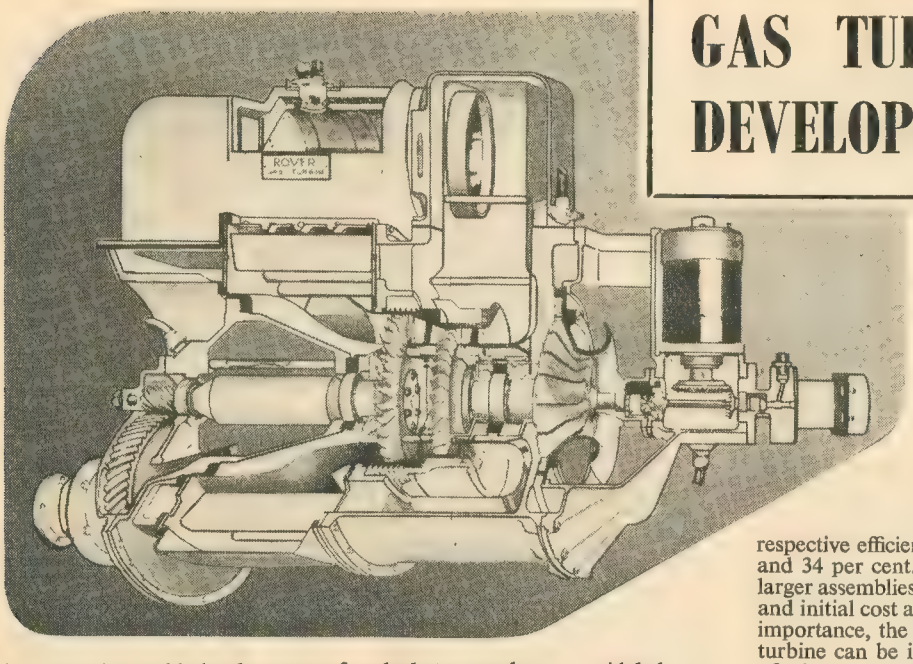
Snifting valve

If a snifting valve, or to give it the "official" title, vacuum relief valve, isn't fitted, there is a tendency for ashes and grit to be sucked down the blastpipe when steam is shut off. Anti-carbonisers are rather out of court on 3½-in. gauge ! The position of this valve is shown in the front view, and a section of the valve is also given separately. It is simply a ½ in. length of $\frac{5}{16}$ in. round rod, drilled 7/32 in. and tapped ¼ in. × 40 with a union nipple silver-soldered into it as shown. The valve seating is made just as described for feed-pump suction valves, except that the bottom is left plain, and is a push fit in a 7/32 in. hole drilled in the bottom of the smokebox. Connect up as shown in front view. Next job, the outfit for 5-in. gauge engine.

"TITFIELD THUNDERBOLT" DRAWINGS

The following are now ready: Sheet 1, General Arrangement, Frames, Wheels, and Axleboxes for 3½-in. and 5-in gauges; Sheet 2, Crankshaft and Motion Details for 3½-in. and 5-in. gauges; Sheet 3, Cylinders and Details for 3½-in. gauge; Sheet 3a, Ditto for 5-in. gauge; Sheet 4, Motion and Reversing gear for 3½-in. and 5-in. gauges; Sheet 4a, "Gab" reversing gear for 5-in. gauge. Price 3s. 6d. per sheet from The Model Engineer Plans Department, 19-20 Noel Street, London, W.1.

GAS TURBINE DEVELOPMENT



The Rover T.8 Gas Turbine engine with the lid off. Note the centrifugal compressor and two turbines, one for the compressor and one for power take-off

IT was the rapid development of the gas turbine for aircraft propulsion, under the stimulus of wartime needs, that brought this type of prime mover before the public. But it was not new ; its principle had been known for many years and a number of experimental models had been built, none with any success.

By the time the 1939 war started, continued experiment in Switzerland had made the gas turbine a practical proposition and this resulted in the building of large units for generating stations and, more sensationally, a locomotive that is still in service. In England, experience was being gained in the construction of compressors and turbines suitable for aircraft application.

Combined with the considerable increase in metallurgic and aerodynamic knowledge of the previous quarter of a century, the gas turbine jet-propelled military aircraft became a reality. In this, the simplest form of the gas turbine power unit, the motive power force is provided by the reaction of the exhaust as it leaves the turbine. " Jet " is a word used indiscriminately, and mostly innaccurately, to describe any gas-turbine-driven machine. As the exhaust-gases leave an aircraft at about 1,000 m.p.h., a truly jet-driven loco or road vehicle would be a terrifying and dangerous object !

In some respects, the gas turbine is similar to the steam turbine, and as the latter may be more widely known and understood by readers, a comparison may be helpful. Both machines possess the great advantage of rotary motion only, with its freedom from vibration, and in both, a stream of hot fluid gives up its energy in passing through a bladed wheel. The working fluid is steam in the one and air in the other. Whereas the steam turbine requires an assured supply of water and a boiler with external heating arrangements, the gas turbine is surrounded by its working fluid and combustion takes place within the unit, thus obviating the inefficiencies of external combustion and the losses involved in transferring heat from the fuel to the working fluid. In the steam turbine, pressures are high whilst in the gas turbine, pressure is comparatively low but the temperature high.

Compared with the diesel or petrol internal-combustion engine, the gas turbine has several advantages. There are very many fewer parts and no reciprocating motion ; bearings are few, cool and easily lubricated. Oil consumption is small, due to the fact that the oil is not in contact with hot surfaces. The weight is very much lower than that of a piston engine of equivalent power.

Its main disadvantage is its high fuel consumption. A thermal efficiency in the region of 18 per cent. cannot compare with that of the petrol or diesel engine with their respective efficiencies of 24 per cent. and 34 per cent. approximately. In larger assemblies where space, weight and initial cost are not of paramount importance, the efficiency of the gas turbine can be improved by the use of heat exchangers, transferring some of the exhaust heat to the air entering the combustion chambers. Such bulky and expensive additions to the simple cycle are not so easy to arrange in aircraft or in road vehicles.

Some of the difficulties involved in improving the overall efficiency of the simple gas turbine will become apparent in a description of the cycle and components. The former is the constant pressure cycle, so called because combustion takes place at more or less constant pressure.

Air is drawn into the system by a compressor and delivered to the combustion chambers with its pressure raised to 40 to 60 lb./sq. in. or more. In the combustion chamber(s) fuel is added continuously and the mixture of air and fuel is burned adding the energy of the fuel to the working fluid. In the resultant expansion, the hot gas gives up its energy in passing through the turbine blades and rotating the turbine. Because the turbine rotor is mounted on the same shaft as the compressor, the compressor also rotates and continues the supply of working fluid to the system.

In starting, the unit is run up to starting speed by an electric motor and ignition is initiated by a spark plug in the combustion system. As soon as combustion has commenced the ignition circuit is switched out and combustion is self-supporting. The system will now continue to

run so long as fuel is injected. Petrol, kerosene, diesel, or lower grades of oil can be burnt satisfactorily.

In the so-called "pure jet" (i.e. reaction motor) all the energy absorbed by the turbine is employed in driving the compressor and it is the exhaust that forms the jet. Sometimes the engine may combine the jet and the airscrew, and when this is done there is a second turbine mechanically unconnected with the first but driven by the energy remaining in the gas after the first turbine has taken sufficient to drive the compressor. The second turbine is connected to the airscrew, and its exhaust usually supplies extra thrust in the form of a jet. This arrangement of compressor and power turbine is also suitable for use in a road vehicle where the turbines form a satisfactory torque converter and the normal gearbox is not required.

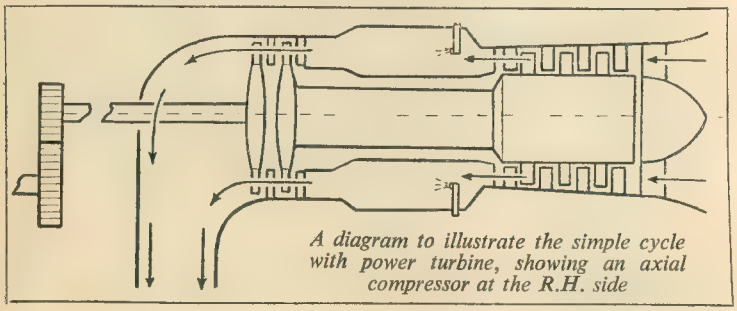
This is the simple cycle and, perhaps with slight additions and modifications, is the most suitable for use in restricted space and in small power units. Several factors are responsible for its low overall efficiency, perhaps the most important being material limitations resulting in the use of much lower turbine inlet-temperatures than would be desirable.

Fundamentally, the output of the set depends on the difference of temperature between the air entering the compressor and that of the gas at turbine entry. It is impractical, at any rate in small sets, to cool the incoming air and it follows therefore that the temperature of the gases entering the turbine must be at the highest temperature that the materials available for the manufacture of turbine blades can withstand. At the moment, this temperature is as high as 850 deg. C.—which is very hot indeed . . . At this temperature the blades are subject to considerable axial, tangential and centrifugal stresses while rotating at speeds between 8,000 and 45,000 r.p.m. Special steels and alloys have been developed to make these temperatures possible and further research may produce materials with the required creep resistant properties to allow the use, perhaps of temperatures as high as 1,500 deg. C.

Another difficulty is introduced as the materials become more suitable ; the temperatures at which they may be forged and worked approach more and more nearly to their melting points, and machining the strictly designed contours of the blades becomes more and more difficult. Casting may be the answer here. Hollow blades cooled by a bleed from the main air supply, or blades of a ceramic material have been the subjects of experiment and may yet be the solution of the temperature problem.

Materials available also affect the design of the combustion chamber(s), though here the matter is more easily dealt with owing to the large amount of relatively cool air entering this part of the system, and higher temperatures here would be possible. As it is, the need to keep down the turbine inlet-temperature results in more air being used than is chemically correct for combustion. The overall proportion of air to fuel may be between 60 and 100 : 1. Such a mixture is much too weak for combustion and the fuel is therefore injected into an inner flame tube where the mixture is approximately 15 : 1. This inner tube receives only a small part of the air, the remainder being added to the products of combustion through suitably disposed holes in the flame tube.

Component efficiencies—those of the compressor and turbine—also affect the overall efficiency of the system. In modern practice these efficiencies vary from 75 per cent. to 85 per cent. for the compressor, depending on the type used, and from 80 per cent. to over 85 per cent. in the case of the turbine. An increase in these efficiencies to 90 per cent. in both components would probably give an overall efficiency that would compare favourably with those of the diesel and petrol piston-engine.



A diagram to illustrate the simple cycle with power turbine, showing an axial compressor at the R.H. side

Turbine efficiencies have been higher than those of compressors, partly because designers had the accumulated experience of the steam turbine on which to build. Compressor conditions are quite different. The compressor must not only compress the air and deliver it without loss to the combustion chamber(s) but also initiate the flow of air in the system. It must deal with vast quantities of air amounting to, for instance, 100 or more tons per hour in some jet engines, without absorbing so much power that there is not enough left for external work. Of the two types in common use, the centrifugal is the simplest to manufacture, but the axial is the more efficient. The centrifugal type depends on rotational speed for its success, but since the tip-speed limit for turbine blades is considered to be about 1,250 ft. per sec., this is limited.

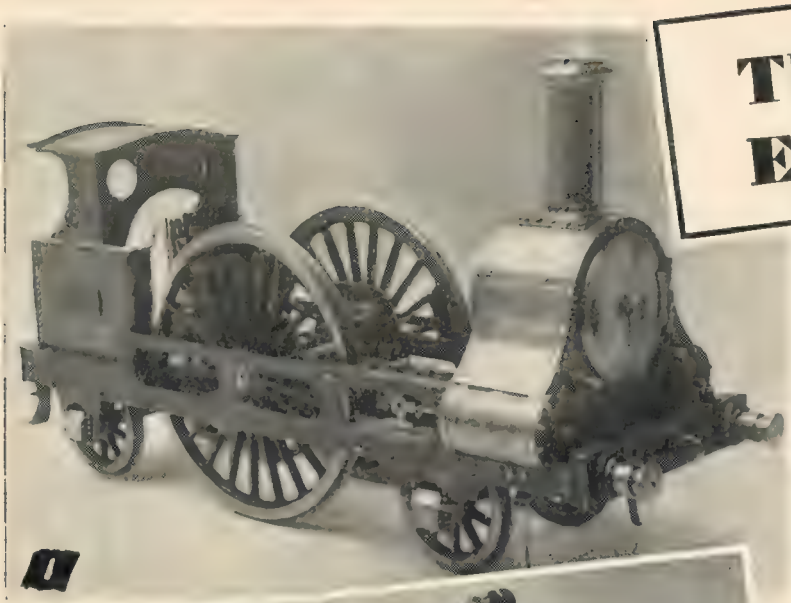
The axial type, with its several rows of alternate nozzles and blades is more efficient than the centrifugal type but more complicated to design and construct. It depends for its operation on the smoothness of the flow around the blades and this in turn depends on the shape of the blades and the angle at which the blade meets the air. Variations in speed and in the mass flow disturb these ideal conditions and are liable to cause a breakdown in the flow with consequent stalling in one or more of the stages. For this reason the axial compressor is more suitable for use where wide variations of speed will not be required.

In some fields such as electric generation and the jet plane the gas turbine is firmly established, but if it is to rival the diesel, petrol and steam power units of other applications further development will be necessary.

The first necessity is the production of materials which will enable the use of much higher turbine temperatures, or the development of methods of cooling the blades without added manufacturing complications. Higher compressor efficiencies will follow aerodynamic experiment; and here, as in the turbine, cheap and rapid methods of blade manufacture must be found. Bearings are no great problem although, as the horsepower of a set is reduced, its rotational speed must increase e.g. the 45,000 r.p.m. of the Rover car. So many obstacles have been overcome that it seems probable that the gas turbine will one day be a dangerous rival to the established forms of prime mover in many power applications.—C.H.H.

The Leeds Exhibition

Reported by "Northerner



(1) *Unfinished model of a handsome L.N.W.R. prototype with 8 ft. 6 in. drivers, built to 1-in. scale by J. A. Hobson*

(2) *David Wanless exhibited this small beam-engine, presented to him by an old engine-tenter*

(3) *E. Cryer built this ¾-in. scale model of a 4-6-0 L.M.S. mixed traffic locomotive*

LOCOMOTIVES were well represented at the exhibition organised recently by the City of Leeds S.M.E.E., and the winner in this section was a ¾-in. scale "Green Arrow" built by J. H. Hainsworth. In fact, this exhibit was also awarded the Leeds Trophy for the best steam-driven model in the exhibition, and the Members' Prize for the best model by a Leeds member.

This engine is very good indeed, both as to mechanical finish and paintwork, and it incorporates a terrific amount of detail. There are three cylinders, of 1 5/16 in. bore by 1⅝ in. stroke, and these are all in one casting, which also incorporates the smokebox saddle. The material used is ni-cast iron, and the ⅝ in. diameter piston-valves run in nickel-chrome liners.

Nickel-chrome steel is used for the connecting-rods and coupling-rods, and it will be noted that the latter are "fish-belly" shaped as in the prototype—the first time I have seen this feature copied on a model.

The valve-gear is all made in K.E. cyanide-hardening steel, cor-

rectly heat-treated and hardened. It is the Gresley two-to-one gear, of course, and all the rods are fluted. The pins and nuts are also cyanide hardened, the latter being of the castle type, locked by tiny split-pins. The return-cranks are fitted with roller-bearings, the rollers being ground and hardened by the builder.

Two rings are fitted to each piston, and the latter are turned in one with their rods, from nickel-chrome steel. All axles are turned in 3 per cent. nickel steel, the crank axle being turned from the solid. Wheel setting is 120 deg., 127½ deg., and 112½ deg.

Wheels are cast in heavy-duty cast-iron, and all bearings are pad lubricated as in the prototype. The bissel truck is fitted with swing links to provide self-centring and super-elevation; the trailing axle is of the Cartazzi type with pivoted bearings, radial slides, and elevating slides.

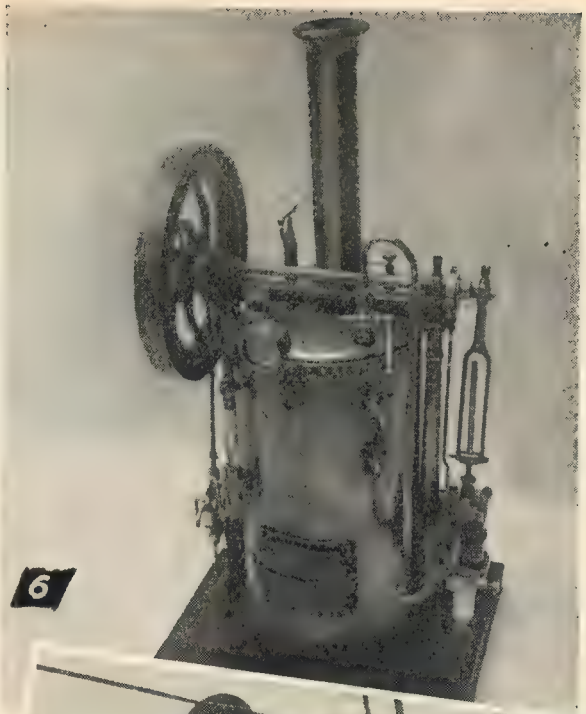
All axles are carried on leaf springs, which have the correct number of leaves. The lubricator is of the displacement type, with sight-feed regulation. A combustion chamber and a four-element superheater are fitted to the boiler, which is bronze-welded throughout.

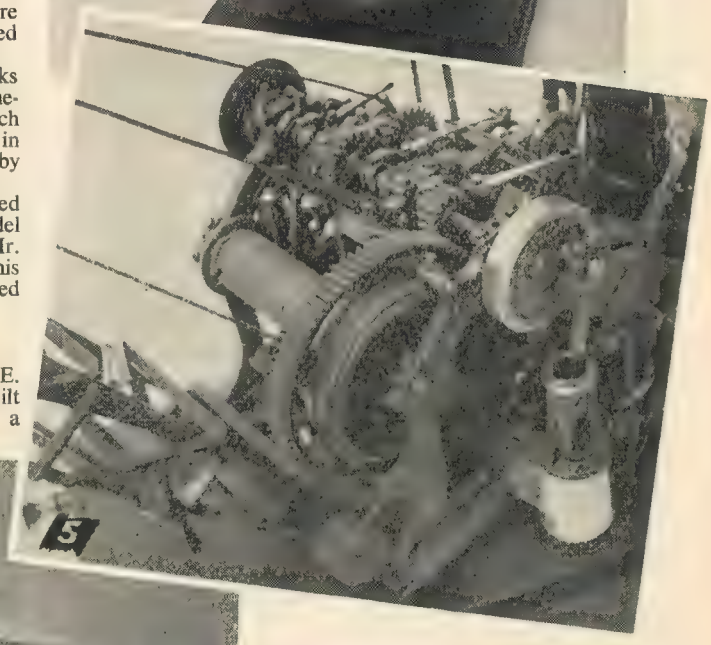
Detail work includes hand-engraved works number-plates on the cab sides, and name-plates hand-carved from solid plastic which was afterwards painted. Painting is in L.N.E. apple-green, lined and lettered by the builder.

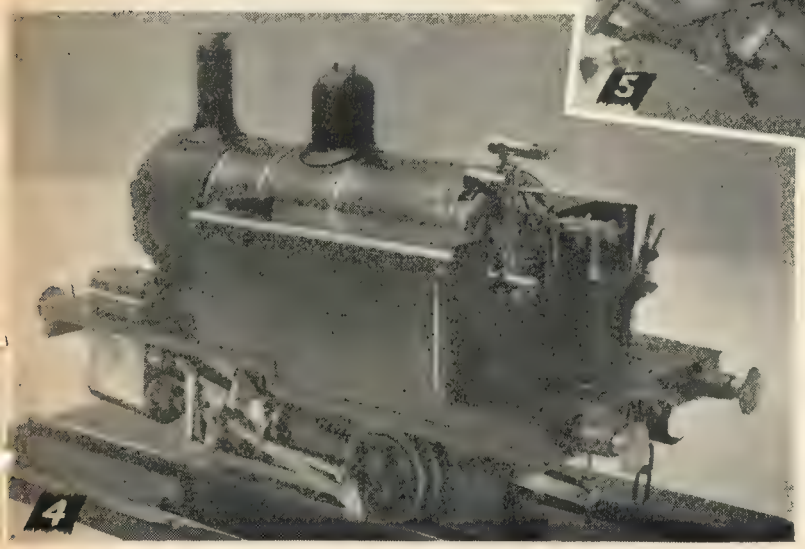
In this engine, the only article purchased is the pressure-gauge. The whole model will bear very close examination and Mr. Hainsworth is to be congratulated on his achievement, as well as on his well-deserved awards.

An L.N.E. Pacific

Another excellent model of an L.N.E. locomotive was a Pacific, *Blink Bonny*, built by C. Lampitt. This locomotive has done a







(6) *An old model of a vertical semi-portable engine exhibited by F. Cook*

(5) *This picture shows the engine and some of the gearing of F. Midgley's Booth steam-crane*

(4) *An example of "L.B.S.C.'s" "Tich" being built by J. S. Jackson. Note the neat toolbox*

lot of passenger-hauling, as was evidenced by the fore-and-aft play present in the big ends of the connecting-rods which are about due for re-bushing. In fact, Frank Cook, genial president of the society, told me the engine has been in steam for hours on end, on many occasions, and puts up a wonderful performance.

In view of the work she has done, it is not surprising that the finish has now lost its original appearance, but the lettering and lining are very neatly done. The engine was built for work, and lacks many of the refinements of the " Green Arrow ": for example, the rods are not fluted, and several large countersunk screws were noticed in places where they need not be.

Mr. Lampitt was also responsible for a nice example of that old " L.B.S.C." favourite *Dyak*, which, in 2½-in. gauge, will haul four adult passengers.

Another handsome engine which appeared to have done a lot of work was the ¾-in. scale L.M.S. 4-6-0 mixed traffic locomotive by E. Cryer. This had a nice mechanical finish, but the paint was rather " bitty "; to some extent this is probably due to the work she has done.

Mr. Cryer also had a *Juliet* with some nice ¾-in. scale goods rolling stock, including a ten-ton wagon, flat wagon, petrol tanker, cattle wagon, and a twenty-ton brake-van. This was quite an unusual exhibit in this scale.

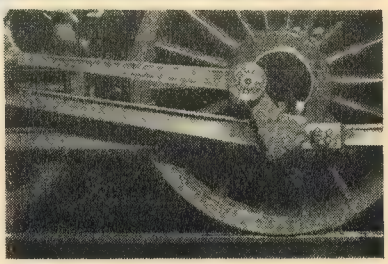
An Old " Single-Driver " Loco.

A part-finished engine which gave many people, including myself, a good deal of pleasure was an inch-scale model of the old L.N.W.R. loco *Cornwall*. The prototype was originally built by Trevithick, and was later rebuilt by Webb.

It is an imposing engine with its 8 ft. 6 in. drivers and double frames. I was told that the builder, J. A. Hobson, had considerable trouble with these delicate driving wheel castings, several having cracked in cooling. However, a good pair were eventually cast for him, and successfully machined.

The model exhibits much beautiful craftsmanship, especially in the cross-heads and motion, and the Stephenson link-motion drives the valves through rocking-levers, the pivots of which are held in massive split bushes. The valve-chests are diagonally over and inside the cylinders.

At the side of the chassis were shown the boiler shell, and some beautifully fretted out splasher side-plates, complete with delicately engraved name-plates. In fact, the workmanship throughout was so good that I was surprised and disappointed to see those countersunk screw-heads obtruding themselves so unnecessarily on axle-boxes, outside frames, and front and rear of smokebox.



Winner of three awards, this ¾-in. scale " Green Arrow " was built by J. H. Hainsworth

Right: Close-up of motion of the " Green Arrow," to show roller-bearing with cover removed

It may be that Mr. Hobson is using these as a temporary measure, of course; possibly he intends to do away with them at a later stage in construction. I hope so, for this model is much too good to be spoiled by their presence on the finished job.

Another unfinished engine was a *Tich* by J. S. Jackson. This too was nicely constructed, with a good mechanical finish and attractive paintwork, but the rods might well have been fluted and the piston-rod boss on the cross-head turned. A very neat little toolbox, with brass moulding, hinges, and hasp, was mounted on the running-board, and the backhead fittings were well done.

Self-Contained

Among the stationary steam-engines was a self-contained one of a type which was quite common at one time, on building-sites driving pug-mills and similar jobs. It was owned by Frank Cook, but the original builder's name is not known; when it came into Mr. Cook's possession he had to spend quite a time on reconditioning it.

A coal-fired boiler is mounted in a cast frame, on which two turned columns support an overhead beam which incorporates the split crank-shaft bearings at either end. One of the columns has a bracket on which the clyinder is mounted, and the other carries the pump.

The connecting-rod is forked, and drives an overhung crank, inside which is the valve eccentric. The valve-chest is inclined on the front of the cylinder, to line up with the shaft. At the other end of the crankshaft is a heavy curved-spoke flywheel of 6 in. diameter, with the pump eccentric inside it.

Boiler fittings include high- and low-level watercocks, as well as a gauge, a column safety-valve, whistle, and blower. Overall height is 17 in. Mr. Cook says he derives a lot of pleasure from this engine, simply by firing her up and watching her, pipe in mouth and sitting at ease. But who wouldn't ?

Young David Wanless got his name in a national daily newspaper as the proud owner of a nice model beam engine, which had been presented to him some time ago by an old engine-tenter. The model is many years old, and possesses some characteristics of the Tuxford make, including cast A-frames to support the beam pillow-blocks, and what might be termed Watt's simple parallel motion.

The beam is a neat casting of 7½-in. centres, the standards and cruciform section connecting-rod also being cast. The centre-line of the beam-bearings is 7-in. above the base, and the flywheel is 8¼ in. diameter.

A Steam Crane

A detailed model of a Booth steam crane, built by F. Midgley, attracted much attention, partly

(*Continued on next page*)

For the BOOKSHELF

The Phantom Railway, by Andrew Wood. (London: Frederick Muller Ltd.) 199 pages, 6 in. by 7¼ in. Price 9s. 6d. net.

This is a pleasant enough story of mystery, intrigue and counter-intrigue concerning the fortunes of a branch line somewhere in the western counties. The time is set in the future, and the excitement builds up to the strange disappearance and subsequent recovery of a British Railways Super-Pacific locomotive which has been designed and built in conditions of great secrecy as a challenge to the railways of the world. But the secret leaks out prematurely, with the result that a Continental engineering concern succeeds in stealing the engine for the sake of its secrets. The tale is well written, full of thrills and excitement, but is entirely free of any of the horrors usually found in modern mystery stories. Even the "villains of the piece" are more crafty than revolting, and the book can be read and enjoyed by readers of all ages.

The British Journal Photographic Almanac, 1954, edited by Arthur J. Dalladay. (London: Henry Greenwood & Co. Ltd.) 636 pages, 4¾ in. by 7½ in., with 32-page photogravure supplement. Price 5s. (board covers), 7s. 6d. (cloth bound).

This almanac, which is now in its ninety-fifth year of publication, continues to hold its place as an authoritative and comprehensive guide to photography in all its branches. The special features in this edition include articles on Nature Photography with Electronic Flash, Colour Quality in Tripack Materials, the use of colour photography in medical work, photographing organs and organists, and the Seven Ages of Photography. The usual up-to-date review of apparatus and materials is included, occupying eighty-one pages, also the Epitome of Progress, which records new methods and technique; modern formulae for the processing of both monchrome and colour materials; and a seventeen-page glossary of technical terms used in photography.

The Steam Locomotive in America, by Alfred W. Bruce. (New York: W. W. Norton & Co. Inc.). 442 pages of text. 64-page art-paper insert for Photograph section. Price $8.50.

This book fills a long-standing gap in the steam locomotive history of the world. Written by an author who has had forty-five years of experience in locomotive building, it bears the stamp of authority and is a valuable contribution to locomotive literature. The steam locomotive developed in America in rather a different manner from that in most other countries, and although the major portion of this book deals chiefly with the development of design and construction during the fifty years 1901-1950, the earlier period from the date of the first American-built locomotive, 1826, is well, if concisely, covered. Numerous charts, diagrams, drawings and tables are included in the text to elucidate technical matters referred to and described, all carefully chosen and clearly presented.

The rendering of the Whyte notation for wheel arrangements is novel to us and, at first, is likely to confuse the British reader; but this is a very minor matter that is soon overcome.

The engine diagrams and reproduced photographs are an education in themselves and give a visual record of the progressive stages of American locomotive development, the greatest rapidity of which took place during the last fifty years. Now that the steam locomotive in America is being rapidly superseded by other forms of motive power, this book not only comes at an opportune moment, but is a worthy and permanent memorial to a remarkable achievement.

The book is obtainable in Britain from the Locomotive Publishing Co. Ltd., 88, Horseferry Road, London, S.W.1, price 45s. net.

THE LEEDS EXHIBITION

(*Continued from previous page*)

because it was uncommon, partly because of its size, and partly because of its complex gearing. It had a jib 28 in. long, and the boiler was 4½ in. diameter and 14 in. high to the chimney-top. The two cylinders were of 1¼-in. stroke, and the bore would be about ⅞ in.; all the motions—lifting, luffing, slewing, and travelling—are derived from the crankshaft.

For lifting, a pinion sliding on a feather on the shaft can be engaged with a large spurwheel on the grooved rope drum. A foot operated brake, held by ratchet, holds the load when the pinion is disengaged.

In luffing, the jib is supported by a wire rope wound round a drum near the base of the turntable. This is driven by a worm on a vertical shaft, with a bevel-wheel at the top; the latter is in constant mesh with a pair of opposed bevels on the crankshaft. Normally these run free, but either can be engaged with a double-ended dog-clutch set between them; which slides on a key on the crankshaft. Thus the jib can be either raised or lowered.

A counter-shaft parallel with and behind the crankshaft takes the drive for slewing. It carries a pair of opposed bevel wheels whose bosses are bored out to form the female parts of cone clutches. Between the bosses, on a key, slide the opposed male cones of the clutches, so that either wheel may be locked to the shaft at will.

Again these wheels are in constant mesh with a bevel at the top of a vertical shaft. The lower end of this carries the first pinion of a triple-reduction gear, whose last motion is a pinion engaging a circular rack inside the track on which the rollers of the crane platform run.

Finally, for travelling, a vertical shaft runs through the king-post on which the platform rotates. At its upper end it carries a bevel wheel meshed with a bevel pinion on the crankshaft, which can be engaged by dog-clutch as before. At its lower end the vertical shaft drives a longitudinal shaft by bevel, and in turn the latter drives both axles, again by bevel reduction gears.

(*To be continued*)

A Progressive Technical College

INTENSIVE TRAINING AT A MIDDLESEX ESTABLISHMENT

By Guy Radcliffe

A student being shown how to set up a Harrison centre lathe for cutting a square thread on a piece of bar. The instructor holds a chuck screw, which is the "prototype"

WHEN the caretaker of Twickenham Technical College goes round all the workshops, laboratories, drawing offices and classrooms at holiday times to close the windows and lock each one, it takes him well over two hours to do the job. This gives some idea of the size of this establishment, but although there is an evening-class annexe at Ashford, a few miles away, it is still not large enough to cater for the needs of all those who wish to further their knowledge of engineering and other trades.

The college was opened in September, 1937, and current demands have necessitated the conversion of storerooms and even sections of corridors into classrooms and laboratories. It is planned to build a £200,000 extension in the near future and other extensions will probably follow later.

The expansion, involving the introduction of more advanced courses and the purchase of additional equipment, corresponds to the increasing specialisation of industry. The best executive and other posts go to men who gain the necessary qualifications for themselves. Not all the students of the college are youngsters; some are in their early fifties. Last year, 70 per cent. of all part-time students were over 21.

Full and Part-time

The engineering faculty covers mechanical, electrical and production engineering, the electrical section embracing electronic and power engineering. In addition there are courses in building, printing and art. The college also has a full-time population of 400 boys of 13-16 years of age, going through their normal secondary education before being placed for and taking up apprenticeships in industry. These boys attend every day, but there are over 1,000 other students each of whom attends one day a week under a part-time release scheme by which employers allow—and persuade—their men to take up training courses at institutes such as the college, no pay being deducted. Many of these students may include former full-time pupils.

Mr. A. G. Webb, B.Sc. (Eng.) Hons., A.C.G.I., M.I.Mech.E., principal of the college, told me that it was the accepted view among many educational authorities that the impact of full-time secondary education under the Education Act, 1944, was unfortunate in that the 400 secondary pupils occupied classroom space and used equipment which could otherwise be used for the benefit of part-time release students from industry.

These more advanced students were, therefore, hampered—and 400 pupils each attending five days a week virtually equalled 2,000, each of whom came one day a week. It was, however, envisaged that the full-time pupils would eventually be accommodated elsewhere, to leave the college entirely for part-time day students and some senior full-time and evening students.

There are more than 2,500 evening students, most of whom are over 21. They attend voluntarily. Last year, the college's roll of all students totalled 4,127 names. Full time pupils, as may be expected, live mostly in the locality, but other students may come from parts as far away as Berkshire and Essex because the college is reasonably near their places of work. Some come from factories on the Slough Trading Estate, Vickers-Armstrong's at Weybridge, and up to 40 soldier students from the depot of the Royal Electrical and Mechanical Engineers at Arborfield, near Reading, attend.

Teaching Qualifications

Personality and the ability to teach, besides the requisite professional qualifications, are demanded of the teaching staff. They must have sympathy with students, and, in fact, the college can afford to have only the best instructors for, at least so far as the voluntary evening pupil is concerned, he will stay away if he finds that he cannot learn under a particular tutor. It is also essential that the teachers be persons of practical industrial experience, acquainted with the latest techniques. For this purpose, some take up temporary jobs in industry as "refreshers" during the summer vacation. Many teachers are part-time and already have responsible work in industry as their main occupations.

Part-time and evening students are trained for the Ordinary and Higher National Certificates of Engineering, with endorsements that give exemption from the examinations of the Institution of Mechanical Engineers, the Institution of Production Engineers and the Institution of Electrical Engineers. In the past few years, some 30 pupils gained the right to add "A.M.I.Mech.E." after their names.

Courses are also offered for those wishing to take the examinations of the City and Guilds of London Institute. Broadly, these examinations are for skilled craftsmen, whilst

those for the National Certificates are for engineers seeking professional qualifications and are suitable for designers, draughtsmen, and research and administrative staffs.

There had been a tendency in earlier years for greater value to be placed by employers on the academic rather than the practical qualifications, but the realisation of the importance of craftsmanship has grown, and of part-time day students now attending the college, about equal numbers are training for the City and Guilds examinations and the National Certificates.

The workshop production course, for the City and Guilds examinations in machine-shop engineering, lasts four years for either part-time day or evening students, the latter attending the college three nights a week for up to 2½ hours an evening. The intermediate examination is taken after two years and the final after four. Further years of study are provided for those who wish to gain associated membership of the Institution of Production Engineers. The college's record of examination successes is better than the national average.

Machine Shop Equipment

Much of the course is taught in the machine workshop, where equipment includes small tools of all sorts, one capstan and eight centre lathes, a battery of drills, and Victoria, Herbert and Richmond milling machines. There is also a Cleveland vertical milling machine, besides a surface grinder, a Matrix internal and external grinder, and a Jones and Shipman tool grinder. Alba and Invicta shaping machines are also installed. The elementary engineering workshop, mainly used by secondary technical students, is less ambitiously but still thoroughly equipped, having an assortment of small tools, a lathe, a vertical drill and a blacksmith's forge.

In the machine-tool laboratory, usually occupied by students of production engineering, there is a Herbert vertical miller, a B.S.A. automatic lathe, a Holbrook toolroom lathe with relieving attachment, and a Ward 3A capstan lathe.

The college plans to replace the present machine-shop equipment in order to keep abreast of modern developments. So far as some of the more advanced production and electronic devices are concerned, they are often outdated before they are worn out, but there is no purpose in holding on to obsolete equipment if men are to be properly trained.

Modern equipment is found in the metrology laboratory, which has checking gauges and precision measuring instruments, and the mechanical engineering laboratory where there is testing equipment for various kinds of structures and power plant. This will be removed to the new extension when it is built.

The practical sections of the workshop production course are marked on a schedule which reads: A, tinplate and sheet-metal work; B, forge practice; C, bench work; D, bench work and machining; E, lathe practice; and F, miscellaneous. Groups of students are rotated from one section to another according to the availability of equipment, rather than all working on one section and progressing to the next simultaneously. All students' work is marked on their individual record cards.

Essentials of Fitting

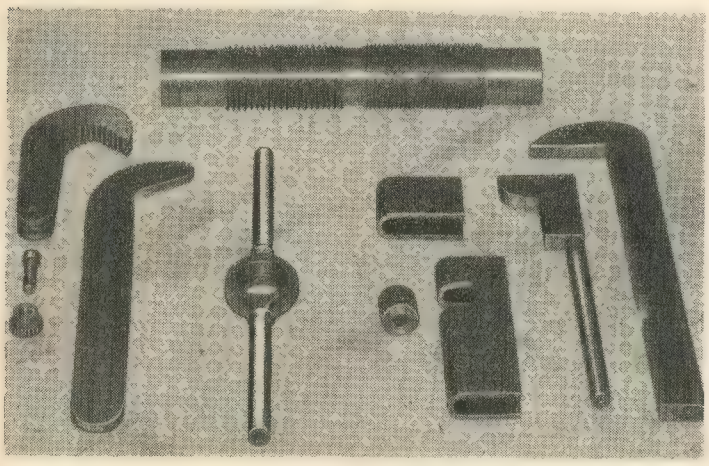
One of the early proficiency tests is to make the traditional square-within-a-square. First-year work includes making a scribing block, a stud holder (involving tapping and drilling), and chisels and centre punches, which give an introduction into hardening and tempering. Making a centre punch is one of the first tasks entailing turning, and further machining processes are involved in making a V-block. Skill in filing is acquired in forming a flat bevel on a centre gauge. The elements of taper turning, knurling, tapping and screwing are acquired in making a tap wrench, and a toolmaker's clamp gives practice in filing, turning and cutting threads.

Pieces made in the second year of the course include an adjustable spanner fabricated from steel plate, with a machine-turned thread. A pipe wrench and a dieholder are also made up from plate, the latter being turned on the arms and profile-turned around the centre. Lathe work in this year involves making left-hand and right-hand threads on a bar.

Lessons learned in these first two years culminate in the third year, in making a machinist's screw jack. The base is finished from a rough iron casting which calls for careful taper-turning and cutting of the internal screw. The threaded portion is made up from bar and the thread is ⅜ in. right-hand with 8 t.p.i. The head is turned to provide a hemisphere and the cap is of brass.

While the instruction is graded to suit an individual pupil's abilities, it is also attuned to the needs of modern industry. First-class workmanship must not entail too much time spent on a job. Therefore, to penalise lack of speed, the instructors' marking system is based on both quality and time taken. For example, when a student is set to make a centre punch in his first year—a task which the instructor can do in 20 min.—he is given an hour in which to complete it. If this is found to be sufficient, he is awarded 10 marks for time, plus those for quality of workmanship.

If, however, he overruns the hour, he has less time in which to do the following task. At the end of the year, his total number of tasks performed are compared with the aggregate time taken, an equal number of marks standing to be gained for both quality and quantity —or output.



Second-year work includes making an adjustable spanner, a die holder and a pipe wrench from steel plate, also turning left-hand and right-hand threads on bar

TEMPERATURE and PRESSURE

USING A THERMOMETER FOR STEAM PRESSURE INDICATION

By K. N. Harris

I CANNOT recollect ever having seen in the columns of THE MODEL ENGINEER any direct reference to the possibilities of utilising an ordinary thermometer for ascertaining the pressure in a steam boiler, or for checking the accuracy (or lack of it !) of a pressure gauge. Small pressure gauges are not, repeat, not, remarkable for their high degree of consistent accuracy, and some simple means of verifying this from time to time is desirable. A number of pressure gauge testing devices have been described in THE MODEL ENGINEER, and, of course, such things are commercial articles, but in either case the time or money involved in procuring one is fairly considerable, and probably in excess of what most model engineers would consider justified. To a large extent, the simple thermometer, preferably marked on the Farenheit scale, provides a comparatively cheap and reliable means of testing the accuracy of a pressure gauge.

I imagine that most readers will be aware that there is a direct connection between the temperature and pressure existing in a steam boiler (so there is, of course, in a boiler using other fluids than water, but such boilers are uncommon, and tables giving the relevant data for fluids other than water are not very readily available).

Saturated steam has, for any given pressure, a definite and invariable temperature, so that it will be obvious that if we know the temperature existing in a boiler and have access to a table of the properties of saturated steam, we can deduce therefrom quite infallibly the pressure existing in the boiler.

At atmospheric pressure (14.7 lb. per sq. in. absolute pressure), water boils at 212 deg. F. and the steam produced has the same temperature, steam in direct contact with boiling water irrespective of the pressure, cannot have a higher temperature than the water.

The table on page 563 shows pressures (above atmosphere) and the temperatures which correspond to them, decimals of degrees being ignored.

The use of the Farenheit scale is advocated for two cogent reasons: (1) Steam property tables almost invariably use it. (2) it gives, for any particular range, a much more open scale than does the Centigrade scale.

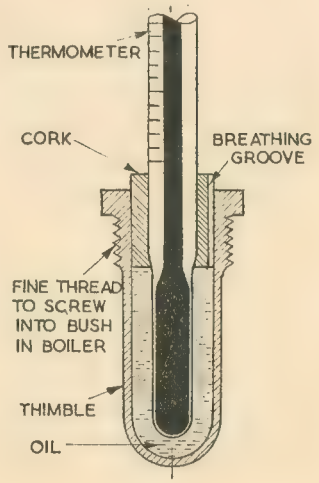


Fig. 1.

Model engineers are rarely concerned with steam pressures in excess of 200 lb. per sq. in., so I have only carried the table to that figure, but should anyone require to go further, any good engineering handbook will give the necessary information. I fully realise that the users of flash steam frequently work at much higher pressures, but they rarely use pressure gauges and their steam is invariably superheated anyhow, which puts the thermometer method of pressure checking completely out of court.

It will be observed that the temperature scale gradually closes for each successive *equal* increment in pressure. Thus, 5 lb. gauge = 228 deg. to 10 lb. gauge = 240 deg. F., an increment of 5 lb. per sq. in. gives a difference of 12 deg. F., but 195 lb. gauge = 386 deg. to 200 lb. gauge = 388 deg. gives an increment of only 2 deg. F.

It will be obvious, therefore, that, particularly when working in the higher ranges, a thermometer having a scale as open as possible is most desirable, and accurate observation of the thermometer readings becomes of increasing importance.

It must be equally obvious that the thermometer bulb (or stem) must on no account be subjected to pressure, and it therefore becomes necessary to make a special fitting to take care of this situation. Fig. 1 shows a suitable arrangement. The space in the pocket surrounding the thermometer bulb, should be filled with a high flashpoint mineral oil; it will be noted that provision is made for the contents of the pocket to breathe, this is important. Mercury could be used in place of oil, but apart from its better conductivity, has no advantages, and has the drawback that the pocket and its fittings would then have to be made of steel, as mercury amalgamates with the brass and copper family.

The use of a small magnifying lens to assist in the accurate reading of the thermometer is to be recommended, and Fig. 2 shows a simple arrangement.

The magnification of the lens need not be high, 2 dias. is ample, and the clip should be only just sufficiently tight on the thermometer stem to ensure that there is no tendency to slip.

The principle is, of course, equally applicable to the testing and setting of safety-valves, or spring or weight-loaded relief-valves of any type.

By and large, the average make of thermometer is a far more accurate and reliable instrument than is the average model pressure gauge, and further, it retains its initial accuracy almost indefinitely, so long as it

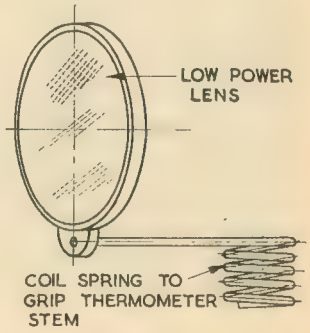


Fig. 2.

is used within the range of its upper limit.

Yet a further application of the thermometer is for setting and/or checking a thermostat (I believe the Gas Board's service men are all issued with thermometers for checking the "Regulos" on gas cookers), and in this field it is of distinct interest to the advanced flash steam enthusiast.

The White Steam Car people used to supply a special high-reading thermometer for checking the setting of the thermostat and pyrometer on their later model cars; it was made up in the form of a flat coil with the bulb turned down in a position more or less co-incident with the centre of the coil, and it was mounted in a brass case with a cover and a removable protecting thimble for the bulb, whilst a special pocket was provided on the thermostat itself to accommodate the bulb.

The auto-control system used on the later White models was highly ingenious, and when working properly gave well-nigh perfect results.

There were three controlling instruments: (1) The pressure control which was a spring-loaded diaphragm-operated valve, subjected to boiler pressure behind the diaphragm, and operating a by-pass on the water supply line; (2) The "Flowmotor" (this was White's own name) which consisted of a cylinder with a well-fitting piston, lightly spring-loaded on its under side, and connected by a rod to a needle valve controlling the liquid fuel supply.

Above the piston was the water inlet, and below, the outlet to the generator; cut in the side of the cylinder was a small taper groove. The piston-rod passed through a gland.

What happened in working was this; the two pumps were always delivering water and this supply was connected to the pressure regulator. When pressure reached 600 lb. per sq. in., the regulator opened the by-pass valve, and allowed all water from the pumps to return to the tank. When pressure fell again, the by-pass closed and water once more passed to the generator. On its way it had to pass through the flowmotor, the more water that passed, the further down the cylinder went the piston to increase the available opening allowed by the groove, and of course, the wider open was the needle valve controlling the fuel. The flowmotor was so arranged that whatever the amount of water passing, rather more than sufficient fuel was passed to the burner to evaporate and superheat the water and steam. Obviously, if left at that, the burner would rapidly overheat the generator, and finally burn out the lower coil or coils (and sometimes when things went wrong, it did !), so a third control was introduced, No. (3) The Thermostat. This was situated in the steam line, between generator and engine, and a copper rod, working through a gland and itself directly exposed to the steam, operated a by-pass needle valve which controlled a supply of water from the feedpumps to the generator *which by-passed the Flowmotor.*

Thus when temperature rose above the pre-determined limit, around 730 deg. F., this by-pass opened and allowed an additional supply of water to pass to the generator, without affecting the fuel supply, thus redressing the balance between water and fuel supply. As I have already said, this system when working correctly was well-nigh perfect, and in many thousand miles driving, I never had any trouble with either Pressure Control or Flowmeter, both were, in my experience, 100 per cent. reliable.

The Thermostat emphatically was not. The design was, in my opinion, distinctly poor, and the feature of the "live" copper element being exposed direct to the steam, and having a slender stem working through a packed gland, was unsatisfactory. If the gland was a bit slack, leakage took place, and anyone who has had practical experience with superheated steam at 600 lb. pressure and 700 deg. F. temperature, knows what its cutting action can be, and the sort of damage likely to arise under the conditions in question. On the other hand, if the gland was the least bit too tight, the slender stem of the copper element seized and just ceased to operate. Curiously enough, the older White system of control, employed up to (I think) about 1907, also utilised a thermostat, which, though it worked under more apparently arduous conditions, being situated in the furnace immediately above the burner, was much more reliable and an altogether better designed job. In this a copper rod was enclosed in a fairly close fitting W.I. or steel tube (I believe the former) which itself was enclosed in the steam pipe leading from the lower generator coil (the superheater coil) to the throttle valve.

The inner end of the copper rod was fixed to the covering tube, the outer end was free and operated a bell-crank, which controlled a needle-valve, which in turn controlled the liquid fuel supply.

With petrol fuel, this thermostat never gave any trouble; with paraffin, I believe, some trouble was experienced with carbonisation, as the fuel could get between the copper rod, and its enclosing tube.

I am inclined to think that with detail improvements in the flowmotor (the water regulator was about as perfect as it could be), and a

Pressure	Temp. °F.	Pressure	Temp. °F.	Pressure	Temp. °F.
0	212	22	263	100	338
1	216	23	264	105	341
2	219	24	264	110	344
3	222	25	267	115	347
4	225	26	269	120	350
5	228	27	270	125	353
6	230	28	272	130	356
7	233	29	273	135	358
8	235	30	274	140	361
9	238	35	281	145	363
10	240	40	287	150	366
11	242	45	292	155	368
12	244	50	297	160	371
13	246	55	303	165	373
14	248	60	307	170	375
15	250	65	312	175	377
16	252	70	316	180	380
17	254	74	320	885	382
18	256	80	324	190	384
19	257	85	328	195	386
20	259	90	331	200	388
21	261	95	335		

NOTE.—Minor discrepancies are due to taking temperatures to nearest degree.

complete re-designing of the thermostat, the later White system of auto-control could be made highly efficient and reliable. Certainly for the amateur, I think such a system is much more likely to be successful than one involving electrical controls, switches and contacts.

The Pyrometer on the later Whites (it was not used with the simpler system of control) was merely to give a visual indication of the temperature of the steam. It, too, was perfectly reliable, its elements consisted of a copper tube projecting into the steam supply line, closed at its lower end and fixed to the dial case at its upper end, containing a loosely fitting quartz rod, resting on the closed end of the copper tube, and bearing at its upper end on a lever, which itself operated an indicator hand moving over a dial. To those interested in Thermostats, I would say, avoid packed glands for the elements of your thermostat like the plague.

All this latter is some way off thermometers and pressure, but does tie up with temperatures and pressures, and may be of interest to those who are themselves interested in the auto-control of flash (or, as I prefer to call them, "Monotube") generators.

Time and Motion Study in Model Engineering

By W. G. Small, M.Coll.H.

IT was after reading a book on "Time and Motion Study" as applied in some American factories, and the results obtained from it, that it dawned on me that, in a modified form, it could be applied to model making to some purpose.

Unfortunately, the time that can be devoted to our hobby, is very limited after all the other calls on us have been met, and to make any progress at all on a large model, necessitates the maximum use of the time on production, and not on switching from lathe to drill and bench to lathe, etc.

After studying my usual methods for a time, I found that the normal routine was to make each part complete as I went along. This involved the use of the lathe, drill, and all sorts of hand tools, files, scribers, rule, hammers, mallets, taps, dies, etc., and the result was that I picked up, used and laid down a large variety of tools; added to this was the fact, that they all had to be put away at the end of the evening. With a spot of timing, I discovered, to my amazement, that 30 to 40 per cent. of the evening was taken up, laying down, picking up, finding, or changing tools.

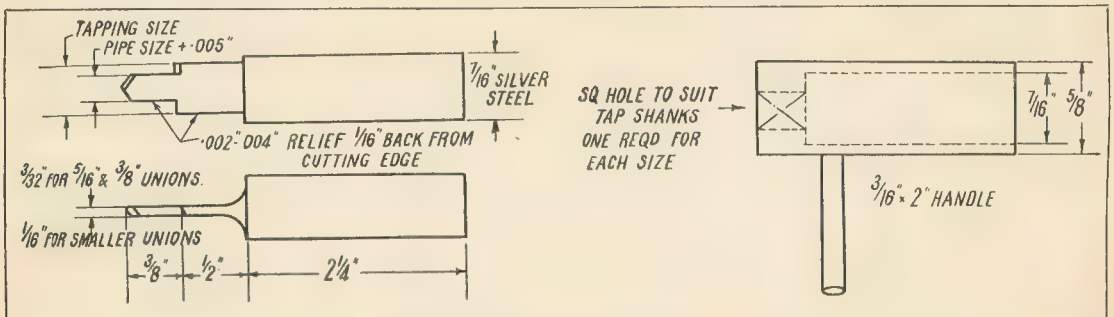
I, therefore, decided to try a method of grouping like jobs together, and started by having an evening on marking-out, an evening on the lathe doing, say, all brass bar work, doing only the jobs that could be done without changing a large number of tools. Another evening was spent on steel turning, another on drilling and tapping. The results were surprising, indeed, and production soared, as only a few tools were in use at one time, and so all useless movement was eliminated. Thus, I got together a large number of individual parts, with nothing actually finished and fitted to its neighbour; but the day comes when assembly starts and it is just a case of putting them all together, which is then a fairly speedy business.

This method stimulates a greater accuracy, as comparative fitting is practically eliminated and accurate measurement and gauging have to be relied on at all stages.

Another way in which time can be saved is to make a number of one-job tools which can do several operations at one setting. For instance, I have made a set of drills which centre, drill pipe size and tapping size for pipe unions. This, with a sleeve which slides over the shank of the drill and carries the appropriate tap and a parting tool in the toolpost, enables union nuts to be turned out *ad lib* without having to change a tool in the process.

While the method has the disadvantage that when a pal pays a visit, he cannot be shown this or that completed, he can at least see a growing box of bits and pieces ! And the days when he can be shown the completed article will come much more quickly !

Admittedly, these ideas will not appeal to everyone, and I have no doubt that many will criticise this method; but I do defend it on the ground that spare time seems to be much less nowadays, and any method which prevents the prolonging of a long-term job such as a locomotive is worth a try.



Union nut drills and tap holders

External Lapping

By "Duplex"

AS mentioned in the previous article, it will usually be found easier to lap a shaft to fit accurately in its bearing than to work in the reverse way. It does not take long to discover that lapping is a slow process, particularly when the work has been hardened, and for this reason only, a very small amount of surplus metal should be left for the lap to remove.

As lapping should remove all tool marks, the work, in the first place, should be turned to as smooth a finish as possible.

Parallelism of the machined work is also important, for if the diameter of a shaft is even 1-thou. in. greater at one end, much additional labour will be needed to correct the error.

Although the use of a fine file for correcting errors in turned work is open to question, in the present instance any inaccuracies or lack of surface finish, resulting from filing the rotating work, will be corrected by the subsequent lapping operation.

It should also be borne in mind that, with the ordinary form of external lap, a bent shaft cannot be made straight by lapping.

The lap itself is, perhaps, best made of cast-iron, as this material is resistant to wear. Copper has the advantage that the hard abrasive grains readily become embedded in the surface of this soft material, and these grains then continue to cut without the lap itself being appreciably worn down. If the lap is required for finishing only a single part or a small batch of components, aluminium alloys or even brass will serve quite well, but laps of this kind soon become worn oversize.

We are fortunate in having a small stock of centri-cast ground cast-iron of the kind used in the motor industry for making valve guides and other parts; this is excellent material for making laps.

The lap holders illustrated in Fig. 1 consist essentially of a brass or steel ring, fitted with three screws.

Two of these screws, on opposite sides of the ring, are used to contract the lap as wear takes place, and they also serve as handles for operating the lap. A third screw has a conical point which engages in a countersink formed in an axial slit cut right through the wall of the lap; in this way, the lap is expanded when the screw is tightened and the two handles are turned back.

To hold large laps more securely, a fourth screw, engaging in a countersink, is sometimes fitted opposite to the expander-screw. A single holder of this kind will carry laps of several different sizes.

Some workers prefer to use quite short external laps, but usually the length of a lap for ordinary work is made some one-and-a-half times the diameter of the bore.

The bore is first drilled and then finished with a boring tool, so that it is left exactly parallel and about 1-thou. in. larger that the nominal diameter. Next, a circular mark is made with a V-tool half way along the outer surface of the lap, and the centres for the countersinks in which the screws engage are then marked-out with a pointed tool while the work is indexed from a change wheel secured to the tail of the lathe mandrel.

If this method of locating the screw holes is also adopted when making the lap holder, the screws will be correctly spaced, and will bear evenly on the lap. After the countersinks or dimples have been drilled, the lap is slit with a hacksaw through the countersink formed to receive the point of the expander-screw.

Where the bore is small in relation

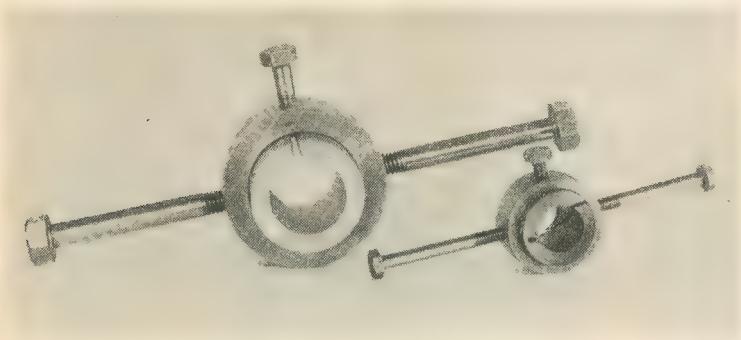


Fig. 1. Two sizes of lap holders fitted with cast-iron laps

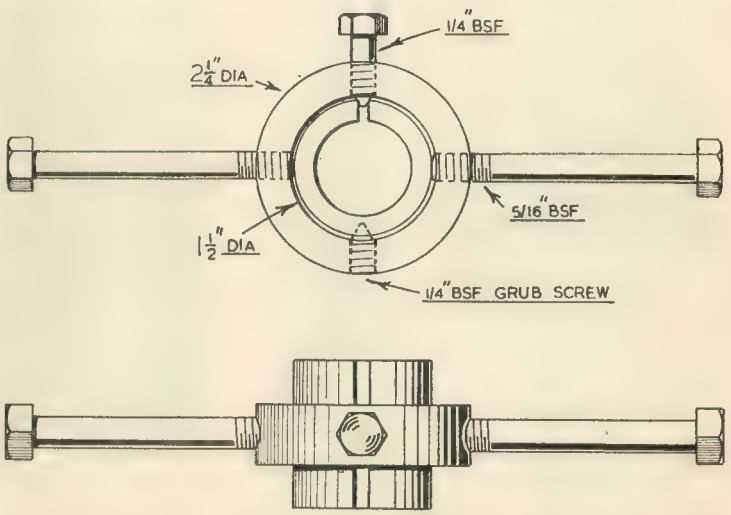


Fig. 2. Constructional details of the lap holder described

Fig. 3. Two cast-iron external laps made from parts of machine castings

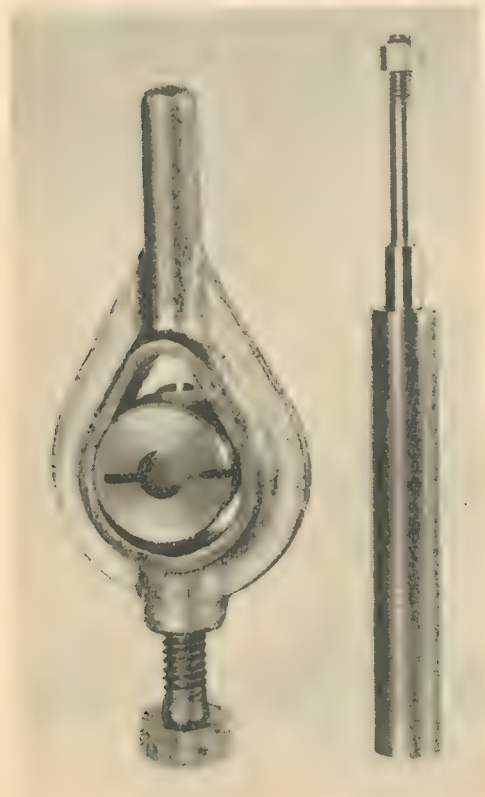
to the outside diameter of the lap, an oblique slit, opposite to the previous slit, is cut partly through the wall of the lap; this allows the lap to contract more readily when the pressure-screws are tightened.

On assembling the lap in its holder, it will be found that, by adjusting the three screws, the opening and closing of the lap can be controlled over a small working range and, in addition, the lap can be rigidly held and locked after the setting has been made. An alternative way of making an external lap is to use an iron casting and dispense with a separate holder.

The method of construction is similar to that already outlined and, after the bore has been accurately machined, the lap is slit and adjusting-screws are fitted. The two examples illustrated in Fig. 3 were made from lugs cut off from a machine casting.

The smaller lap, of ¼ in. nominal size, has been drilled with an additional axial hole to afford easier contraction without danger of breakage. To provide an accurate means of adjustment, and to enable the lap to be locked after setting, an expander-screw is fitted, in addition to the contracting-screw forming the handle. The larger lap illustrated has a bore of 1¼ in. and, as the bore opened out when the slit was cut, only a closing screw is needed. This lap, in conjunction with the internal lap described in the previous article, was used successfully to lap the bearings of a machine spindle to an accurate fit and a high surface finish.

A convenient way of lapping the hollow gudgeon-pins fitted to small internal combustion engines is to mount the pin on an arbor of the kind illustrated in Fig. 4. The nut serves to secure the pin in place, and the round shank is gripped in



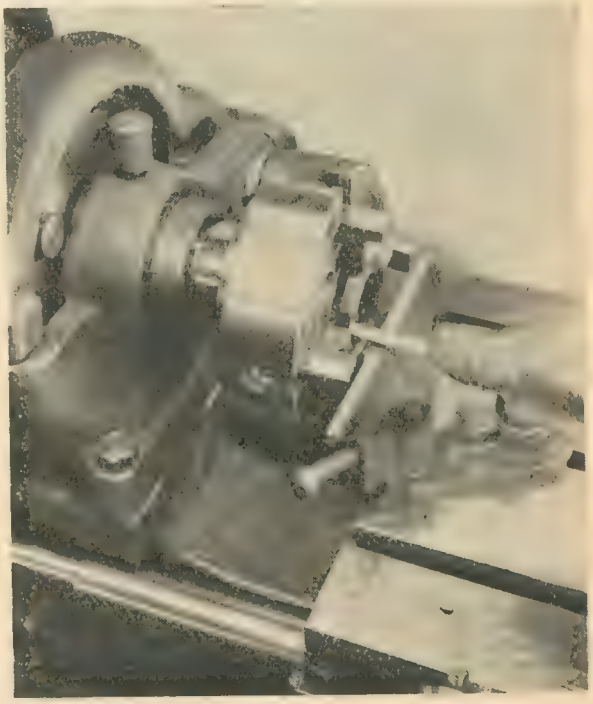


Fig. 5. Lapping thrust-races in the lathe

Left: Fig. 4. An arbor and a lap used for fini hing small gudgeon-pins

the chuck of lathe or drilling machine. The cast-iron lap is made in the same way as in the previous examples, and is held in a small lathe carrier. The screw of the carrier engages in a dimple formed in the lap, and also provides a means of closing the split lap to the working size. If the hardened gudgeon-pins are rotated at high speed and a fine abrasive is used with the lap, a very high and accurate finish is easily obtained.

If the work is not too lengthy and is reasonably rigid, it is best gripped in the lathe chuck without support from the back centre, for withdrawal of the lap for cleaning is then quicker and there is no danger of the abrasive damaging the back centre. Some work-pieces are, however, more conveniently dealt with when held in the chuck of the drilling machine. The kinds of abrasives used, and the method of their application, are similar to those described for internal lapping. From time to time, both the lap and the work should be cleaned with paraffin to remove the metal dust and worn abrasive. A little paraffin applied to the work will keep the lapping compound from clogging and scoring the work surface.

Continue the lapping until the micrometer applied to the clean work surface shows that the required diameter has or has very nearly been reached; then try the shaft in place and, if necessary, go on lapping. In the final stages, some workers obtain an exact fit by moving the lap to and fro with the work remaining stationary.

Both the parts must now be again thoroughly cleaned with paraffin and, if they mate as a push-fit, the shaft is given a final lapping to establish a working clearance. For this purpose, an abrasive of from 500 to 700 grain size can be used, and with the Carborundum Company's 2A-700 compound, a high polish can, if required, be given to the work without removing any appreciable amount of metal.

After again being cleaned, the dry shaft should turn smoothly in its bearing and, if a little oil is applied, a distinct drag should be felt due to shearing the oil film. As an example of a close running-fit, the hardened rollers of a filing rest spun freely on their spindles after the parts had been lapped, but when oil was applied, a marked drag developed and it was found necessary to run the bearings dry in order to obtain satisfactory working.

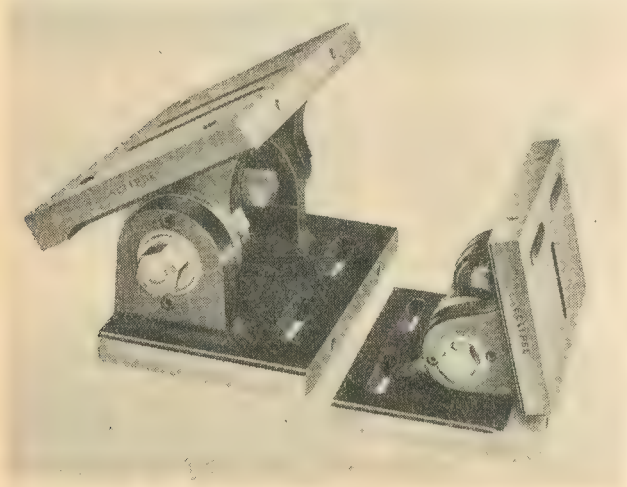
Lapping Ball Thrust-races

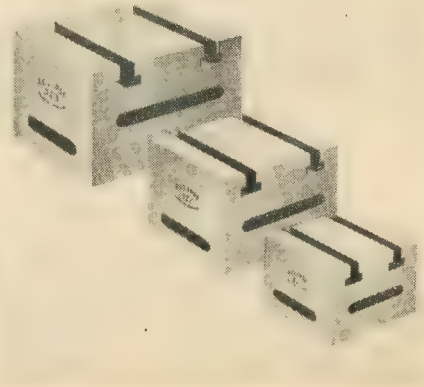
When thrust-races are made in the workshop, and after they have been hardened, the ball tracks will have to be lapped to a smooth finish in order to obtain a proper bearing surface and to ensure quiet running. This can be done without difficulty by gripping the bearing in the lathe chuck and pressing a stick of hard wood, charged with abrasive, against the ball track. As shown in Fig. 5, the rounded lapping stick is supported on the lathe hand-rest, and is then worked evenly from side to side to cover the whole of the ball track.

ECLIPSE MACHINE TOOL FIXTURES

MESSRS. James Neill & Co. (Sheffield) Ltd. have sent us particulars of the Eclipse swivel angle plates and box angle plates, which are made in sizes to suit lathes and other machine tools within the scope of light engineering, tool instrument and model making. The former are designed to give a low overall height, to make the most of available headroom on small machines, and have separate swivel joints, with friction washers to facilitate setting, and calibrated angular indices. Tapped holes in the edges of both base and swivel plates enable stop plates to be fitted when required. Two sizes are available, the smaller being 5 in. in length, 3¾ in. in breadth, and 3 in. height when parallel, and the larger being 7 in., 5 in., and 4 in. in respective dimensions.

The box angle plates provide the basis for machining jigs of various kinds, enabling work to be carried out on up to five faces at one setting; they also facilitate the mounting of rough or part machined castings on the faceplate or machine table, and can be used as parallel or right-angle packings. They are made in three sizes, the smallest being 3 in. in length, 2½ in. in breadth and 2 in. in height, and the others 4 in. by 3⅜ in. by 2¾ in., and 5 in. by 4¼ in. by 3⅜ in. respectively.





READERS' LETTERS

EX-SERVICE COMPRESSORS

DEAR SIR,—In Vol. 102, No. 2561 of June 22nd, 1950, an excellent article was written by "Siskin" on Government Surplus Piston-type Compressors. I am wondering if ever since, any readers have designed and produced a combined outrigger bearing and foundation casting.

It seems that many readers must have obtained these compressors and needed such an adaptation, and I should like to get into touch with any such readers with a view to borrowing patterns, or purchasing castings if available.

Yours faithfully,
Bury St. Edmunds V. MARRIAGE.

DANGEROUS CHEMICALS

DEAR SIR.—We wish to refer to Mr. E. C. Wright's letter on the above subject, March 18th issue.

This company has been manufacturing selenium rectifiers for the past sixteen years, during which time many millions of selenium rectifier plates have been produced. Throughout this period no case of poisoning has been brought to our attention, either by the users of the rectifiers, or the workers engaged in the manufacture.

We trust this letter will serve to reassure users of selenium rectifiers that no hazards exist.

Yours faithfully,
STANDARD TELEPHONES AND CABLES LIMITED.
Boreham Wood. E. A. RICHARDS.
Chief Rectifier Engineer.

AVELING & PORTER T.E. No. 721

DEAR SIR,—I have turned up a note in *The Engineer* that, at the Wolverhampton Trials, at the request of Lord Vernon, a special test was made of the 6-n.h.p. A. & P. engine. "Keeping steam and water perfectly," this 7¾ in. × 10 in. engine running at 175 r.p.m. indicated 41.19 h.p. Steam pressure is not given, but I believe it was 115 lb.

The Aveling "fifth wheel" steerage seems to have been adopted originally as a substitute for the horse in the shafts of portable engines converted to chain driven T.E.s. Apart from taking up space, a defect was the inability to alter the steering lock with the engine stationary, a disadvantage in setting up threshing tackle.

Yours faithfully,
Ruardean. R. C. STEBBING.

INFORMATION WANTED

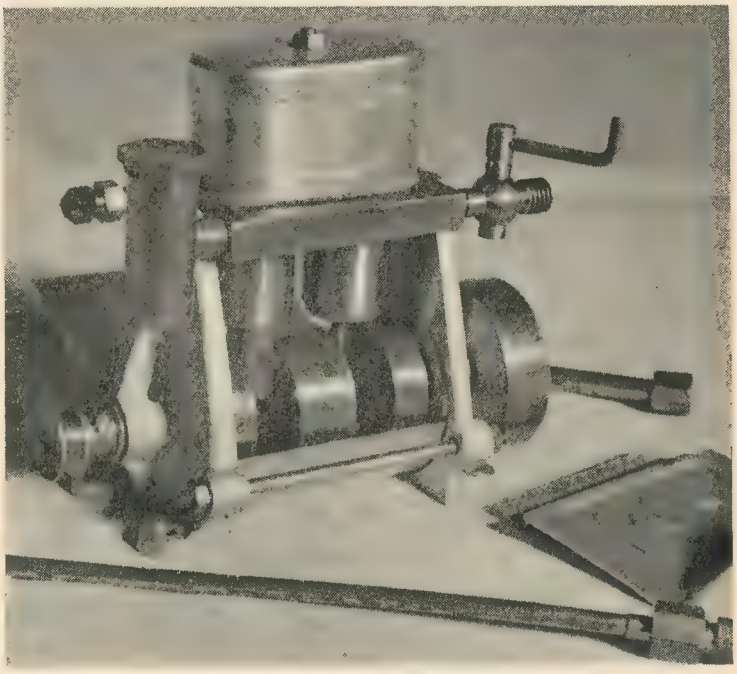
DEAR SIR,—I will be glad if one of your readers would provide me with some "gen" on a model marine engine which I purchased in Salisbury, Southern Rhodesia. I wrote to the makers, Messrs. Bowden Models, only to have my letter returned by the G.P.O. London with the cryptic inscription "gone away."

It is a twin-cylinder, ½ in. bore by ½ in. stroke, to be powered, I presume, by steam. The "valve" system puzzles me most, as I have not yet read an article or letter in your magazine which mentions this type, and I have been a regular reader for nearly four years now.

Both pistons have an "S" shaped groove in one side and are bored through from the crown to the top of the groove. The pistons themselves seem to have an eccentric ball-joint at the "little-end" of the connecting-rods which causes the piston to move round horizontally a couple of degrees each way on both strokes. Having no boiler available to try the engine out under steam, I have nevertheless had it running on about 50 lb. pressure of compressed air which made it tick over quite well, but a little roughly. I would very much like to know something of the performance of this type of engine, and the size of boiler I should acquire to provide a power plant for a model of about 3 ft. length.

The photograph reproduced herewith illustrates my rather amateurish description.

Yours faithfully,
Cape Town, S.A. F. RAYNER.



A DRILLING MACHINE

DEAR SIR,—Commenting on "Old-Timer's" letter in the April 29th issue, what does one do if one's grandfather had not the foresight to leave one a tool kit containing a drilling column, a boilermaker's clamp, a ratchet brace and square-shank drills? Surely it is better to make the best use of the equipment already in the workshop rather than to rely on the forethought of a grandfather.

Yours faithfully
Newbury. "Tubal Caine."

Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

PRECISION GROUND STEEL

DEAR SIR,—May I attempt to clear up one or two points on this question of P.G. Silver-Steel. As I have ground many tons of this and other materials over the last 20 years, I can understand what has happened and I sympathise.

These "waves, lobes," or whatever you like to call them are really nothing more than a "chatter" mark met with in centreless grinding—and, I believe, in centreless turning. The trouble is they cannot be readily seen, especially when only slight, and cannot be found with a "mic." they are, in fact, a precision grinder's headache as well as the user's; but I hasten to add that every precaution is taken to see that the material is not dispatched in this state. If the purchaser would just roll the piece between thumb and forefinger on the table, any tendency to be out of round can be felt, and I am quite sure any respectable firm would be only too pleased to replace.

On the question of ends that are "glass hard" mentioned by Mr. Hughes, he is quite right; silver-steel is cut by an abrasive disc—but not quenched. Normally this cuts cleanly and efficiently, but the human element comes into it again; the operator may "dwell" in the middle of a cut and unnecessary heat is generated, hence a glass-hard end. But these can be annealed by holding the end in molten lead and then allowing it to cool slowly; in this way the surface will not suffer.

The term "precision ground" means commercially + or — 0.00025 in.; finer limits are ground, of course, but only to order, and these limits can and are being centreless ground; in fact, the British engineering industry lives on it, so if one or two of you get hold of a bad 13 in. length of silver-steel, examine it and send it back if you are not satisfied.

Yours faithfully,

Warrington. J. GREGORY.

UNUSUAL TENDERS

DEAR SIR,—I write this since it may interest small-locomotive builders and model engineers in general. I was down at the coast on my annual holiday and on my last day there, I naturally went to the railway station to await the homeward-bound train. The station was in a small town called George. While strolling along the platform I noticed the shunting engine puffing up and down the line, doing nothing in particular. I was puzzled by it, for it did not seem to be quite right. Then I saw the "tender." It was another locomotive of the same size, turned upside down and mounted on wheels. The coal was kept in the firebox and the water in the boiler, which, doubtless, had no tubes. I had never seen a tender like this and was fascinated by it. The light was perfect for photography, but my camera was empty.

I thought that this tender must be unique but, on awakening the following day, several hundred miles north of George, I was surprised to see an almost identical tender attached to a locomotive; I thought it might be the same, but I remembered that the George model had been kept extremely clean, the bright parts polished and the rest nice and black, while this was very dingy all over.

Model engineering in South Africa is not very advanced. My own workshop is only a figment of my imagination, although one shop I know of is selling an average of one M.L.7 lathe per day; I am glad to see that cheaper lathes are being introduced to this country, since this brings my "workshop" more within the bounds of reality.

Yours faithfully,

Johannesburg, S.A. J. FAJERMAN.

SUPERHEATER, ETC.

DEAR SIR,—I was very pleased to read "L.B.S.C.'s" article in your issue dated April 15th. Recently, Mr. Maskelyne has delivered before the Society of Model & Experimental Engineers of London, a series of lectures on The Design and Development of Model Locomotives. In the last lecture the question of superheat was raised, and the value of same as applied to a model locomotive was discussed.

One of our most experienced members stated, that from the experiments he had made he doubted if the superheater as applied to a model locomotive was really effective or was even much of a steam drier. My own opinion is that we owners of model locomotives are not concerned in the least about the degree of *superheat*, if any we get, but we are concerned to get the steam into the cylinders as hot and dry as possible. I assert we do accomplish this fact in models of ¾-in. and 1-in. scales, and by so doing, achieve the object we set out to attain, viz., save water and coal; in other words, the engine gives much better results from a given quantity of coal and water and the boiler can make all the steam the cylinders require, without excessive use of the blower, etc.

I know this point is strongly contested by one of our oldest and most informed members, who contends he has proved that *in the engines he has tested*, he could detect no difference; *but*, the engines on which he experimented had only one or two superheater flues; whereas if he had tested a more modern boiler with say, four flue tubes, he would have found a very marked difference in the working.

The question of superheating appears to be developing on the same lines as the argument in the past, as to there being any value in "notching up" in a model locomotive. The late Mr. Greenly asserted that it had no value in a model. In spite of my very great respect and admiration of Mr. Greenly, he was definitely wrong in this assertion, as well as on the standard he adopted, of bore of cylinder should be the same as the unit of scale. You have only to watch and listen to, say an express passenger engine of 1-in. scale with 1¼ in. bore and 2 in. stroke working, then wait till another engine of same scale is put on, with cylinders of 1⅛ to 1⅛ in. bore and 2⅛ in. stroke, to see the value of this point.

Yours faithfully,

West Wickham. G. W. VICKERAGE.

SYNCHRONOUS CLOCK MOTORS

A Correction

In the article on "A Simple Electric Clock," by Mr. A. R. Turpin which appeared in the issue of THE MODEL ENGINEER dated April 22nd, it was stated that the synchronous motor used in this clock was obtained from Messrs. H. Franks, of 58, New Oxford Street, London, W.C.1. As a result of queries arising out of this statement, we have now learned that our contributor made a mistake regarding the source of supply. This particular type of synchronous motor is supplied by M. R. Supplies Ltd., 68, New Oxford Street, though other types which can be used for constructing electric clocks can be obtained from the first firm mentioned. In the circumstances, we express our regrets for any inconvenience which may have been caused to either firm.

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Speeds and Power for Lathe

Will you please inform me of the correct *speeds for turning all the usual materials on a 4-in. lathe. What method should be used for checking or counting the speeds of the lathe? What size of motor is required to produce ample power to run on* 110 *volts, d.c.? Should it be ¼ h.p. or ½ h.p.,* 30-40 *amps*?

A.G.C. (Goole).

It is impossible to answer this question in definite terms. The fact is that the cutting speed depends on several factors, including the kind of tool steel used, the rigidity of the machine tool employed, and also the exact composition of the metal or alloy that is being machined. For instance, it may be mentioned that two different samples of mild-steel might require totally different machining speeds, and the same applies to cast-iron, brass and aluminium alloys.

In the case of silver-steel, the degree of annealing may affect the rate at which machining can be carried out. In the circumstances, we do not propose to commit ourselves to a table of so-called "correct" cutting speeds. You can sometimes find tables of cutting speeds in text books, but they apply only to one particular set of conditions, and will be found to vary according to the authority quoting them.

For checking either rotational or peripheral speeds, there are several kinds of speed indicating devices available, but generally speaking, the rated speed of the motor, in connection with the belt or gear reduction to the machine, is relied upon. In actual practice, the only sure guide to cutting speeds is experience.

With reference to the power of motor required for machining, a ¼ h.p. motor will be large enough for most work you are likely to encounter, but we do not understand your figure 30 to 40 amps, as this is far more than a ¼ h.p. or ½ h.p. motor should consume. We may mention that if you are inexperienced in lathe work, one of the following books would be extremely useful:

Beginner's Guide to the Lathe. Price 3s. 6d.

"*M.E.*" *Lathe Manual.* Price 12 s. 6d.

Screw-cutting Indicator

I have made several attempts to cut a 19 *threads per in. standard pipe thread on a Myford M.L.7 lathe equipped with a dial thread indicator. Although I engage the clasp-nut only when the dial reads* "1," *the tool has failed to follow the thread and has wrecked what thread has previously been cut. Is it not possible to cut* 19 *t.p.i. using the indicator*?

H.L. (Hull).

We are quite unable to understand why you have encountered any difficulty in the use of this device for cutting threads of 19 t.p.i. If the clasp-nut is engaged only when the dial reads "1" it should pick up accurately on any whole number threads.

One point which should be noted, however, is that when the indicator is first fitted to the lathe, the dial may not point *exactly* to the fixed index mark when the leadscrew-cut is engaged, and this should be corrected by inserting packing of the required thickness in between the indicator and the side of the lathe saddle, until the marks exactly coincide. Unless this is done, there is a possibility of error occurring when the nut is engaged, but the important thing is that engagement should take place at exactly the same point in the rotation of the dial on every occasion, with all backlash in the change wheels and other working parts taken up in the right direction.

Power Lineshaft for Workshop

I have built a garden workshop from Anderson shelter material, and I propose to mount on it a heavy bench 8 *ft. by* 2 *ft.* 3 *in., with a top* 3½ *in. thick, to carry a* 3½*-in. lathe, a grinder and a drilling machine, and possibly one or two other machines later. I propose to drive this by means of a lineshaft from a ½-h.p. motor, The roof of the workshop is made from lapped sheets* 6 *ft. long, bolted with ½-in. bolts, and I propose using these bolts to fix wooden beams to carry brackets for the plummer blocks for the lineshaft, at* 5 *ft.* 6 *in. centres. I have* 3*-ball-bearing self-aligning plummer blocks for* 1½*-in. shafts, and should be glad to know whether* 1½*-in. shafting will be too heavy for my purpose. Would it be better to make bushes from* 1½*-in. shaft, and bore them to take* 1*-in. shaft*?

R.C.R. (London, E.12).

The 1½-in. shafting which you suggest is unnecessarily large for carrying the power you propose to use, but there would be no great objection to using it, as it would not necessarily put any greater strain, except a little extra weight, on the structure.

As, however, pulleys and other fittings for the shafting would be more expensive in 1½-in. size than 1 in. size, the idea of using 1-in. shaft, with steel bushes pressed over it to run in the 1½-in. bearings, would be quite in order.

Next Week . . .

WORDS OF WISDOM
In another of his inimitable Lobby Chats, "L.B.S.C." gives some hints and a warning to drivers of small locomotives.

SMALL BOILERS
If you have been waiting for more information on boilers suitable for model stationary and marine engines, you will want to read the next instalment of Edgar T. Westbury's Uutility Steam Engines Series.

SOMETHING NEW
Locomotive enthusiasts will welcome the authentic drawings, description and photograph of the new British Railways Class 3, 2-6-0 type locomotive just completed at Swindon Works, Western Region.

"NORTHERNER" REPORTS . . .
A final review of the Leeds Exhibition by our Northern Correspondent with photographs of some of the excellent marine models, steam engines and workshop equipment he saw there.

SPRING FASHIONS
What should the well-dressed small loco-driver wear? C. R. Fox's amusing and instructive illustrated feature will tell you.

. . . AND THE "REGULARS"
These are only a few of the things which, together with our popular regular features, you will find in next week's MODEL ENGINEER—obviously an issue not to be missed!

WITH THE CLUBS

The Society of Model and Experimental Engineers

The next meeting of the society will be at Caxton Hall, on Thursday, May 20th, at 7 p.m. The speaker will be our vice-chairman, Mr. A. L. Hutton, and his topic will be "On Making Things Hot." We have already had a hint or two of Mr. Hutton's original methods, and this should prove of great interest to all who, from time to time, have to deal with the problems arising from lack of elaborate heating apparatus. Visitors will be welcome.

Full particulars of the society may be obtained from the Secretary: E. C. YALDEN, M.C., 31, Longdon Wood, Keston, Kent.

Harrow and Wembley S.M.E.

The launching ceremony of the marine section model tanker "Club Spirit," will take place on Sunday, May 23rd, at 11 a.m., at West Harrow Recreation Park Boating Pond. The launching will be carried out by Commander Craine ("Jason"). "Club Spirit" was built by the marine section of the society, taking about four years to complete. After the launching, many of the members' prototype model ships will be operating on the pond.

Hon. Secretary: K. D. CARTER, "Hedgely," South Approach, Moor Park, Northwood, Middx.

St. Albans and District M.E.S.

St. Albans & District and North London Societies are holding a power boat regatta at the Lake Verulamium, St. Albans, on Sunday, May 23rd, 1954, commencing at 12 noon. Programme:—Nomination, radio control event. "A," "B," "C," "C" restricted class hydroplanes, steering.

Hydroplane event will be as follows: This is a combined event covering classes "A," "B," "C," and "C" restricted, with two runs per boat as follows:—

One run through the classes commencing with class "A" boats, followed by classes "B," "C," and "C" restricted. The class "A" second run will follow immediately after the completion of class "C" restricted first run, continuing until all classes have completed two runs.

Hon. Secretary: St. Albans Society: P. LAMBERT, 13, Tassell Hall, Redbourne, Herts.

The Cumberland Guild of M.E. & C.

Work on an outdoor 3½-in. and 5-in. gauge track for our locomotive section is progressing steadily. We have almost completed the fabrication of a 63 ft. steel bridge, which we propose using to save filling in a deep hollow at the south end of our 800 ft. circuit.

Our locomotive section is flourishing strongly, with six locomotives of various gauges completed and a baker's dozen or more on the stocks.

Two of our junior members entered their locomotives in the County Annual Youth Art and Handicrafts Exhibition, at Cockermouth recently. Brian Miller (15) sent his 5-in. gauge "Rainhill," Allan Nicholson (16) a 2½-in. gauge incomplete model "Canterbury Lamb," and both received the Red Star—top quality highest awards.

We hope to have our track going this summer, perhaps for August holidays, then, after a month or so respite, we will commence erection of our workshop/clubroom adjacent to the track site immediately situated in front of Curwen Hall, Workington.

Membership is open to all who are interested in craftsmanship of any kind.

Hon. Secretary: W. TULLY, 28, Coronation Road, Maryport, Cumberland.

North London S.M.E.

It has been decided that an exhibition shall be held this year, and further particulars will be available shortly.

Requests for the society's support at fetes with locomotives, cars, and aircraft are heavier than ever; and we are obliged to decline, in some cases, due to triple dating.

General meetings are held by courtesy of Eastern Gas Board at their offices in Station Road, New Barnet, at 8 p.m., on the first Friday of each month.

Hon. Secretary: W. W. RANSOM, 6, Arundel Court, 127, Woodhouse Road, N.12.

Huddersfield S.M.E.

Open days to be held at Highfields Centre Track and Pond are:—

Sunday, June 13th, at 11.0 a.m.
Saturday, July 10th, at 2.0 p.m.
Sunday, August 15th, at 11.0 a.m.
Saturday and Sunday, September 11/12th, at 11.0 a.m.
Saturday, August 21st. Regatta in Greenhead Park.

Secretary: F. W. L. BOTTOMLEY, 763, Manchester Road, Huddersfield.

The Welling & District M.E.E.S.

We are holding our annual regatta on Whit. Saturday, June 5th, 1954, at The Belvedere Recreation Ground, and a cordial invitation is extended to all.

The events are for free-running boats only, and will include the following:—

(1) Nomination, 40 yd. approx.
(2) Steering competition.
(3) Club relay nomination.
(4) Radio control competition.

Please note that intending competitors may run as many boats as they wish in any one event, but are only allowed to take one prize in any one event.

In addition to the above events, the club locomotive track (3½ in. and 5 in. gauges) will be in operation at the side of the pond, giving rides to children; visitors with engines who wish to have a run will be very welcome.

Will all intending competitors and clubs kindly inform the secretary so that arrangements for refreshments can be made.

Power Boat Secretary: J. G. SLENDER, 44, Hartford Road, Bexley, Kent.

The West Riding Small Loco. Society

We shall be holding track days throughout the summer on the first and third Sundays in each month, and we shall be open to the public. The second and fourth Sundays in each month are reserved for members and guests.

The track is approximately one-eighth of a mile continuous and multi-gauge 2½-in.-7¼-in., and we offer a welcome to any club or individual who wishes to visit us and take advantage of our very fast track.

Sunday, July 11th, is our "invitation day" for locomotive clubs and locomotive owners, and we hope that this year we shall again repeat the successful day we had in 1953, when clubs from as far afield as Middlesbrough and Burton-on-Trent accepted our invitation.

Full particulars of our society can be obtained from our secretary:—F. W. SPENCER, 179, Raikes Lane, Birstall, nr. Leeds, Yorkshire.

Edinburgh S.M.E.

The second of our club evenings was held on Tuesday, April 13th and an enjoyable evening was held, culminating in footplate reminiscences by Mr. Shepherd.

Our next outing is a visit to the *Scotsman* office on May 26th, at 7.30 p.m.

The club rooms and workshop are open on Tuesday evening at 7.30 p.m. and on Saturday afternoon from 3 p.m., and all interested are welcome.

Hon. Secretary: JAMES H. FARR, Wardie Garage, Ferry Road West, Edinburgh, 5.

Billericay S.M.E.

The society has now installed electric light in the headquarters, this is being run off a generator, a product of the society, and the hut has now taken on an air of permanency.

The construction of the "OO" gauge layout is progressing. More hands are wanted for this work, especially people who do not mind the more mundane things that are bound to occur when construction is under way.

A group of the society's models was recently exhibited at the local Arts and Crafts Exhibition, and these brought forth many interesting questions.

There are some interesting activities going on at the hut, and most important is the fact that the whole thing is run on very informal lines.

We are urgently requiring new blood and anybody in the district who is interested in any form of model making is invited to contact the undersigned who will gladly send all details or arrange a visit to the headquarters at any time.

R. LEACH, 6, Mayflower Road, Billericay, Essex, Public Relations Officer, Billericay Society of Model Engineers.

THE MODEL ENGINEER DIARY

May 23rd.—Harrow and Wembley Society of Model Engineers. Launching of a 52-in. model tanker at the West Harrow Recreation Ground Pond at 11 a.m.

May 23rd.—St. Albans and District Model Engineering Society and North London Society of Model Engineers. Regatta at Verulamium, St. Albans, Herts.

May 30th.—Forest Gate Model Power Boat and Engineering Society. Regatta for free running boats only, at Victoria Park, Hackney, E.9.

June 26th and 27th.—Birmingham Society of Model Engineers. National Loco Rally at Campbell Green.

July 10th and 11th.—International Radio Controlled Models Society. Annual Contests for radio controlled models, to be held in Birmingham.—Model Boats on July 10th, and Model Aircraft on July 11th.

August 18th, 19th, 20th, 21st, 23rd, 24th, 25th, 26th, 27th and 28th. THE MODEL ENGINEER Exhibition, at the New Horticultural Hall, Greycoat Street, Westminster, S.W.1. Open from 11 a.m. to 9 p.m.

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CORRESPONDENCE

The Managing Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Correspondence and manuscripts should not be addressed to individuals, but to the Managing Editor, THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

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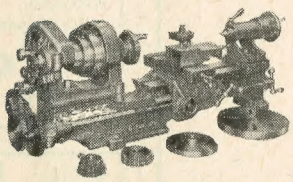

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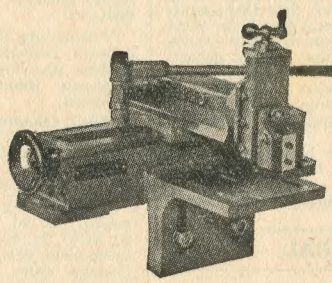

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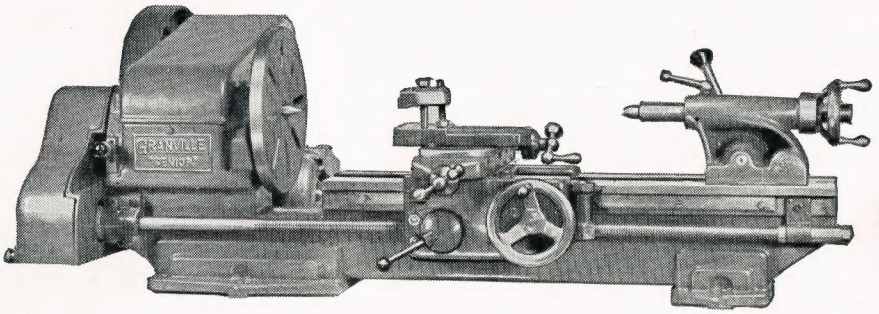

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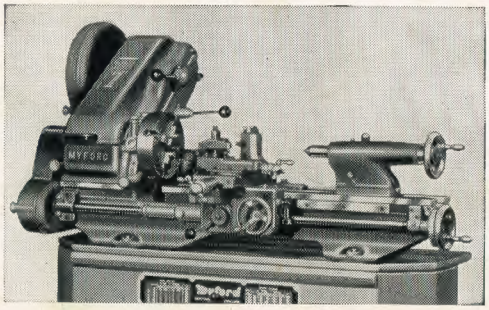

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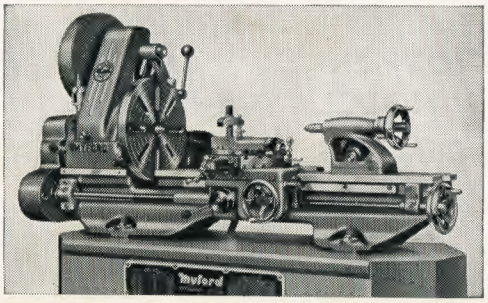

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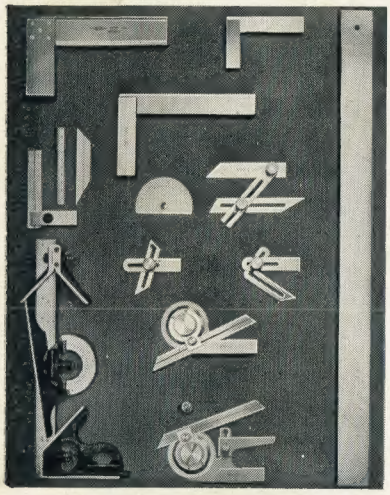

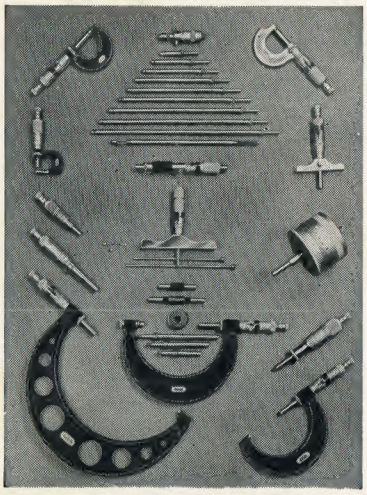

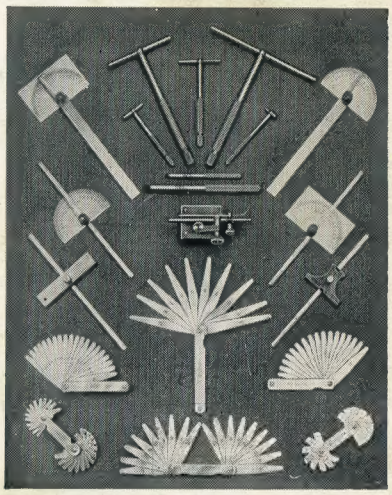

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